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Smithsonian

Volume 18, Number 11

Table of Contents

Cover: Day Three of the contest sees GM's *Sunraycer*, all 390 pounds of it, increasing its decisive lead (p. 48)
Photograph by Peter Menzel

12 *Smithsonian horizons* by Secretary Adams
18 *Letters to the Editor*
24 *Picture credits*
28 *Around the Mall and beyond* by Edwards Park
38 *Phenomena, comment and notes* by John P. Wiley jr.

48 **Fill 'er up—with sunlight**
The first World Solar Challenge draws international teams to compete in a unique, high-tech car race
By William H. Jordan jr., photographs by Peter Menzel

62 **The superstardom of David Hockney**
Innovative and irrepressible, the best-known British painter alive gears up for a brilliant new exhibition
By Helen Dudar

78 **A petroproblem for the lynx**
In Alaska, forecasts for the solitary, snow-loving cat are clouded by cheaper oil and changing fashions
By Bil Gilbert, photographs by Alan Carey

92 **On the trail of Fletcher Christian**
A quest for clues to the fate of the famed *Bounty* mutineer takes a kinsman to remote Pitcairn Island
By Barnaby Conrad

112 **The hipness of being Cajun**
The world is dancing to the homegrown tunes of South Louisiana, music once scorned as "chank-a-chank"
By Jim and Carlotta Anderson
Photographs by Philip Gould

128 **Revenge of the trolleys**
City streetcar systems, jilted when America fell in love with autos, are now being wooed to fight gridlock
By William S. Kowinski

142 **Probing the ozone hole**
NASA targets the causes of an opening in Earth's ozone layer—our shield against harmful UV radiation
By Ellen Ruppel Shell, photographs by Ian Yeomans

158 **Snakes, the streamlined predators**
All-time losers in mankind's popularity polls, limbless serpents do keep down our varmint count; still . . .
By Adrian Forsyth
Photographs by Michael and Patricia Fogden

168 **Will James was a complex cowpoke**
Boyhood visions of the American West drew him to it; he spent a hectic life portraying the cowboy he became
By Frederick Turner

184 **Tree huggers of the Himalaya**
To save their dwindling forests, people in northern India ward off axmen by bravely embracing the trees
By Robert A. Hutchison

198 *Book reviews*
203 *Additional reading*
205 *February events at the Smithsonian*
209 *Smithsonian seminars* (*Smithsonian tours* are on page 111)

212 **'Triumph,' 'biumph' or, maybe, 'monumph'**
By John Skow

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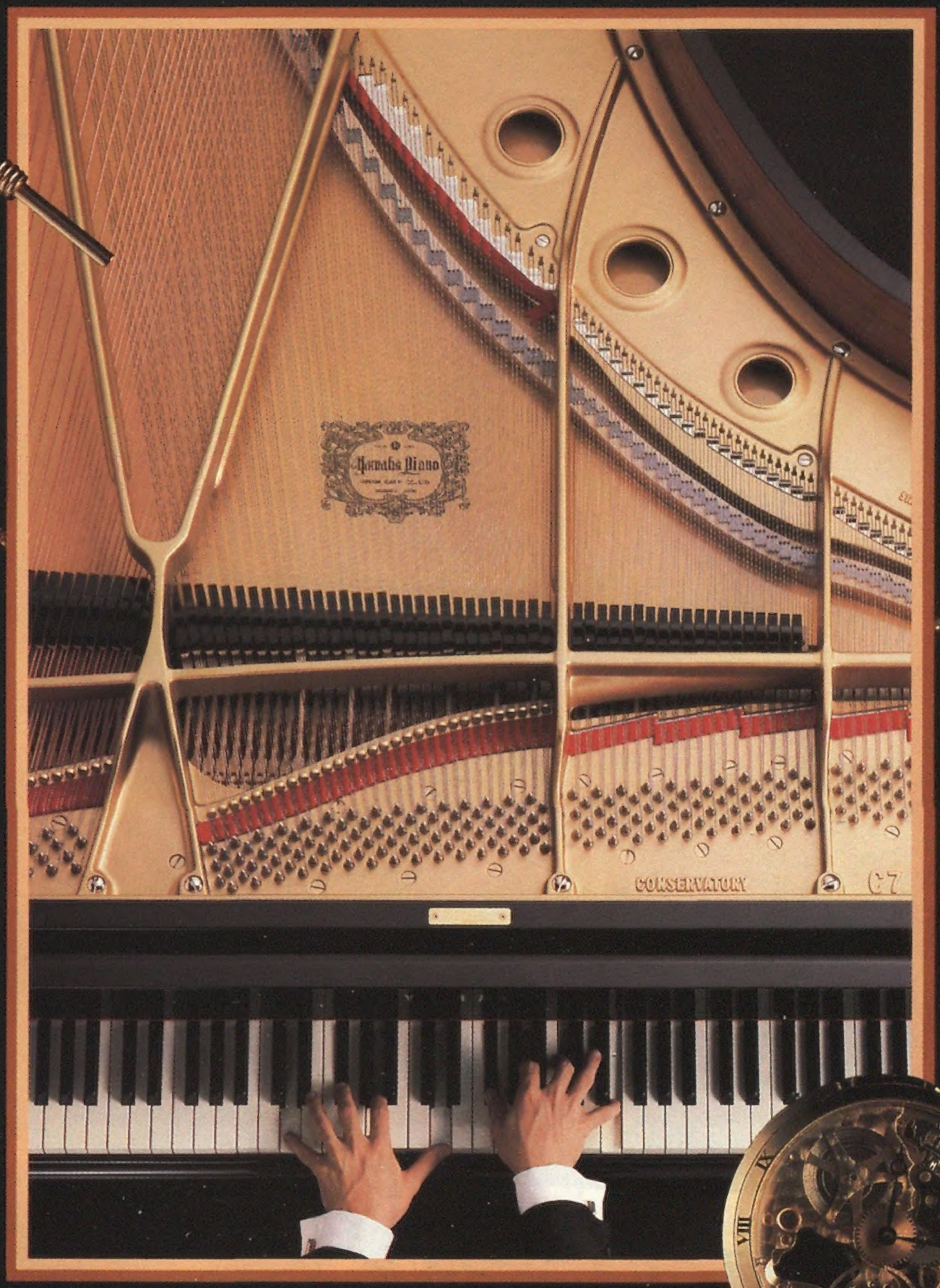

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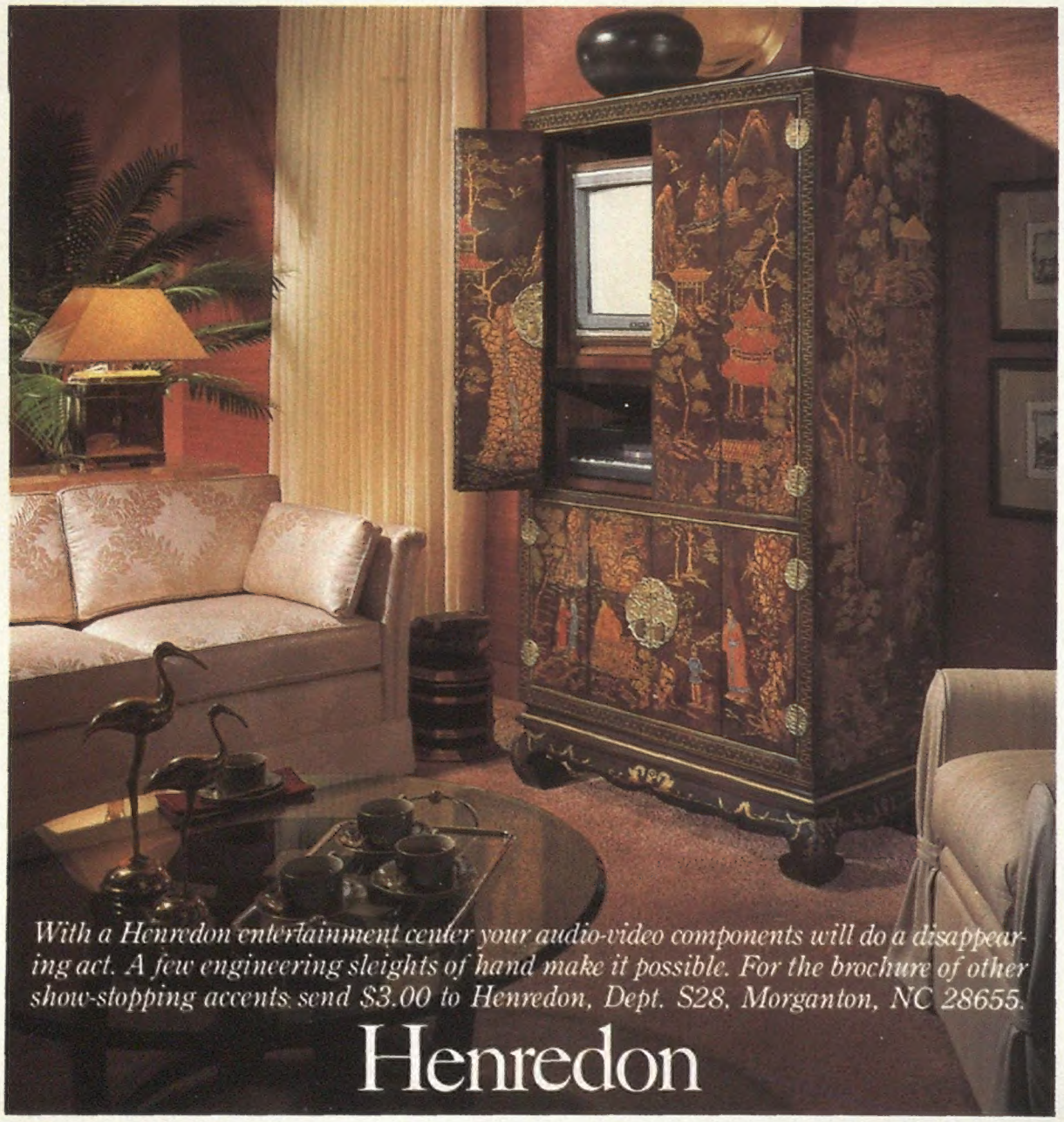
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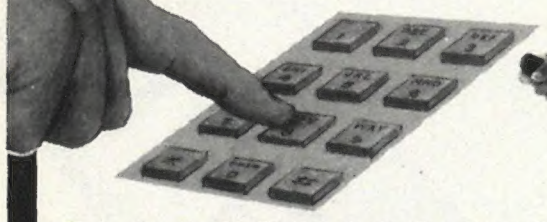

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Smithsonian horizons

Awards and other acts of recognition are beneficial to science as a part of the support system that sustains its advance

I reported last month on the award of the General Foods World Food Prize to Dr. M. S. Swaminathan, in recognition of his leadership in the Green Revolution that introduced high-yielding wheat and rice varieties into Third World agriculture. Contrasting sharply with my own pleasure over this occasion was a letter received while the column was on press. The writer, unconcerned over the merits of Dr. Swaminathan in particular, took general exception to essentially everything about scientific prize-giving.

Perhaps he deserves a serious response. Among his criticisms were that highly publicized prizes of the Nobel and World Food variety distort, or are at best irrelevant to, the motives that impel individuals toward real scientific achievement; the competition they stimulate is a destructive diversion, akin to political maneuvering or advertising; many equally good and accomplished individuals are ignored for every one who is honored; and from a cost-benefit point of view, the prize money represents a missed opportunity to support many worthy causes more directly.

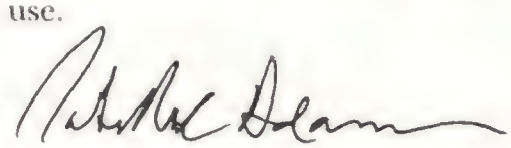
What is the case in rebuttal to such views? To start with, science is unthinkable without institutional arrangements for the exercise of organized skepticism (a phrase originated by Robert K. Merton). But passive checks are equally unthinkable without a correspondingly positive set of inducements to spend a lifetime trying to overcome them. Processes of competitive evaluation with winners as well as losers are, in short, necessary rungs in any ladder of scientific achievement. These are foreshadowed already in student examinations and then continue (only taking different forms) through professional or academic appointments and promotions. They are not less recognizable in the review of articles for publication in prestigious, refereed journals and in the "peer review" of competitive proposals for research funds. Thus the really great annual awards are only the culmination of the process.

Beyond this, prestigious prizes should not be viewed in isolation. In fact, they constitute only one element in an intricate and subtle combination of internal gatekeeping structures. Complete or fixed consensus would make science, or indeed any field of achievement, into a prison, but fragile, shifting areas of agreement help to focus interest on especially productive approaches or problems. "If politics is the art of the possible," Nobelist Sir Peter Medawar once noted, "research is surely the art of the soluble. . . .Good scientists study the most important problems they think they can solve." Formal recognition of a capacity to recognize "hot" problem areas is among the influences that shape and stimulate career paths. And the awards or other acts of recognition, for all of the unfortunate hyperbole that may accompany them, then go on to highlight role models for new generations to aspire to follow.

Harder to come to grips with are suspicions of unfair advantage. Careful studies have been conducted of various systems of peer review of research proposals. This is perhaps the most significant source of competitive stress, since most forms of research are greatly delayed, if not crippled, without external funding. The fact of a relative concentration of awards within a limited number of research-oriented institutions is undeniable, but it is paralleled by a concentration of applicants in them also.

But what if wealth buys reduced teaching schedules, superior laboratory equipment or libraries, and senior "stars" as faculty colleagues from whom one may seek guidance? Clearly, if indirectly, the institutional setting matters at least to the extent that it contributes to proposal quality. Then, for those of Nobel stature, there is what Merton has termed the Matthew effect: For unto everyone that hath shall be given. The award itself may have the consequence that their earlier and subsequent contributions are ratcheted upward in esteem. But do their co-workers and students gain unfairly by association—or has a deserved act of recognition enhanced their opportunities to select those with greater potential?

As for cost-benefit analysis, the span of comparison must be narrow if it is to have any meaning. Largely anecdotal points of contact aside, the immediate alleviation of human hunger and the long-term implications of scientific discovery simply cannot be balanced within the terms of a single equation. Our common humanity requires that we divert more resources to the former, but undermining the support system that sustains the advance of science is not the way to do so. Quite incidentally, Dr. Swaminathan plans to use the prize money to experiment on bringing small farmers in the Himalaya foothills into active policy planning about land and water use.



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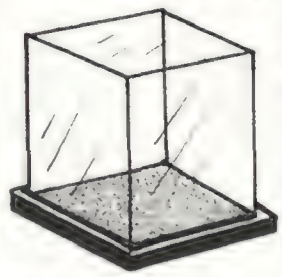

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Letters to the Editor

The siege of Quebec

Dear Sir: In your December issue, I was sorry to find you swallowing that old chestnut about the origin of Return Jonathan Meigs' name. The yarn—I'll admit it's cute—has been floating around for nearly a century, started by heaven knows who, its truth never doubted by those who repeat it.

Return Jonathan Meigs (1740-1823) was the fifth child, third son of Return (no middle name) Meigs and Elizabeth Hamlin Meigs of Middletown, Connecticut. There is no record of how the original Return Meigs got his name, but it was not unique—a Return Strong is mentioned in the Colonial records of the state of Connecticut.

My interest in the matter arises from my being a son of the 9th Return Jonathan Meigs, brother of the 11th and uncle and great-uncle of two later ones.
B. V. Meigs
Basking Ridge, New Jersey

Dear Sir: I am directly descended from Return Jonathan Meigs. I have in my possession—substantiated by a letter to Colonel Meigs' son, Return Jonathan Meigs of Ohio—General Montgomery's shoe buckles, given to the then Major Meigs after the general's death at the Battle of Quebec. Colonel Meigs was one of the first settlers of the Territory of Ohio and a supporter of the Cherokee Nation, by whom he was called "The White Path." He died at the Cherokee Agency in Ohio in 1823.

The story of the origin of the family name Return was often told me as a little girl by my grandmother.
Caroline N. Smith
Garden City, New York

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Dear Sir: Mr. Park's fascinating article could leave one with the impression that Col. Roger Enos was a traitor. He was a veteran of Bunker Hill who later became a general and did, indeed, found the town of Enosburg Falls, Vermont.

When you consider the bare facts of the assault on Quebec—ill timed, ill conceived and ill executed—Roger Enos should have been followed by all the army when he left the expedition. Benedict Arnold was far from being a "tactical genius"; his "outstanding leadership" led to a fiasco at Quebec. When Mr. Arnold turned his coat he did America a favor, and lived to be despised by both the Americans and the British.

Hurray for General Enos!
Mollie H. McCain
Jackson, Michigan

Tiffany's

Dear Sir: In the 1890s my great-great-grandmother was courted by two men. After she made her choice, the rejected suitor took her to Tiffany's and bought her a silver dressing-table set. He selected something that would be in constant use so she'd think of him daily.

I think of that man often as I pick up great-great-grandmother's mirror—and wonder about her thoughts when she looked into it.
Susan Schock
Encinitas, California

Roy Chapman Andrews

Dear Sir: As a teenager, one favorite haunt was the American Museum of Natural History, and I was familiar with Mr. Andrews' expeditions. In 1938 my father gave me a camera to photograph some of the museum's exhibits. I was sent to a top-floor office for permission. To my surprise and delight, Mr. Andrews himself gave me the go-ahead.
Turner O. Veith jr.
San Antonio

Dear Sir: The rifle held by Andrews on page 96, incorrectly identified in your text as a 6.5mm Mannlicher, is actually a solid-frame Savage Model 99 rifle, probably .300 caliber, based on the diversity of work intended for it at the time.
Dale O. Rolfe
Kalamazoo
Several readers—and Savage Industries—maintain that the rifle is indeed a Savage, probably a Model 20, either a .250 or .300 caliber. But other experts are equally certain that the rifle is a Mannlicher. Ed.

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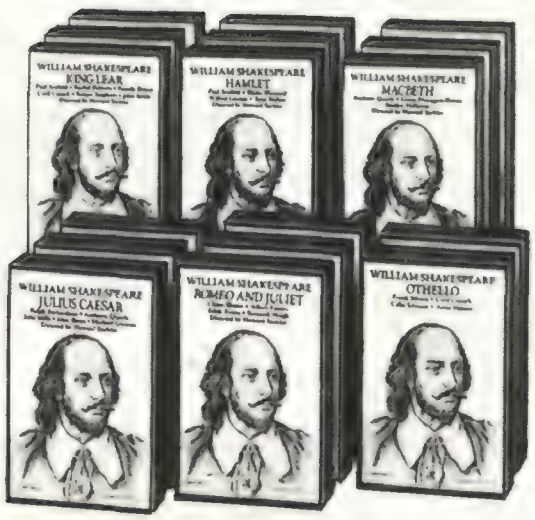

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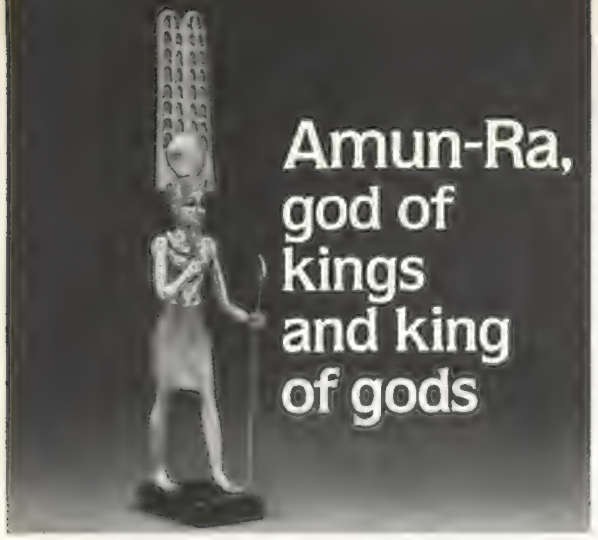

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Dear Sir: Why was Roy Chapman Andrews asked to resign from the American Museum of Natural History? When a small boy in the 1920s, I read with great excitement of his discoveries of dinosaur eggs. Later, *National Geographic* published even more fascinating stories of his work in Mongolia.

The wonderful Charles R. Knight paintings in the AMNH (below) captivated me and started me on a lifelong hobby of vertebrate paleontology.

Bill Brooks
Indianapolis

Writer Douglas Preston discusses the firing in his book, out last month. Neither a desk worker nor an administrator, Andrews wanted to mount expeditions that, during the Great Depression, the museum could not afford. In financial doldrums, with staff morale abysmal, the trustees hired a consultant; his recommendation: get rid of Andrews. Ed.

The dinosaur Apatosaurus was known as Brontosaurus when painted by Knight.

Sleds

Dear Sir: Your article does justice to the great Flexible Flyer in all respects save one: its durability and longevity.

When I was born, in 1921, my grandfather, who worked as a machinist for sled manufacturer Samuel Allen in Philadelphia, gave me a Flexible Flyer. Our family album is replete with yellowing photographs of me being pulled down snowy Philadelphia streets by my father while still so young as to need the support of a box mounted on the sled.

As an adolescent in the suburbs, I reveled in winter because my Flexible Flyer was the fastest sled on the hill. I was a belly-whoppin' hell-on-runners! When in due course my son and then my daughter appeared, the box went back on the Flexi and the cycle began again—to be repeated a generation later as my son's children matured from box riding to belly-whopping.

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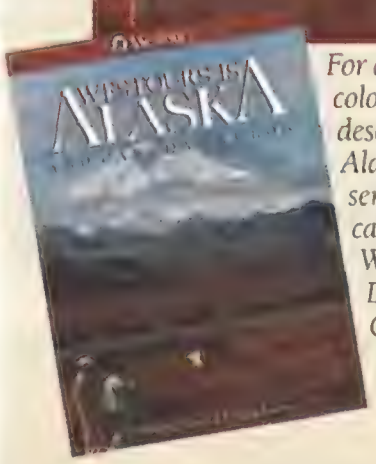

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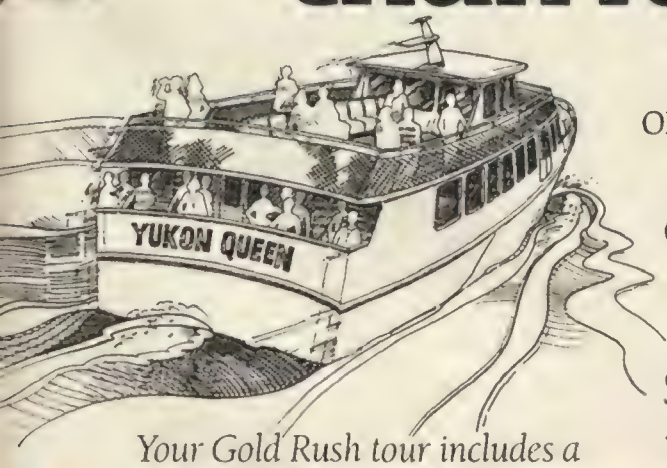

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Now the old Flexi rests in a York County barn. But the original donor's great-great-granddaughter is to be married in the spring, and there is every reason to believe the Flexi will yet serve the great-great-greats of the man who helped make it.
Clark D. Moore
Langhorne, Pennsylvania

El Escorial

Dear Sir: Süleyman I (The Magnificent) died in 1566. Had he been around to oversee the Turkish fleet in 1571, perhaps Lepanto would have turned out differently.
Scott H. Ochiltree
Washington, D.C.
The fleet that fought at Lepanto was indeed the one Süleyman had built up; whether the outcome of Lepanto would have been different had he lived we'll never know. Ed.

Dear Sir: In the contemporary painting of the Battle of Lepanto, the ships are not galleons, which have no oars. They are galleys, the formidable and maneuverable oared warships of the Mediterranean, which had been in use since ancient times.
William J. McPeak
Lake Forest, California
For committing this classic blunder, may we be mistaken for a galleass. Ed.

Around the Mall

Dear Sir: In the Smithsonian fire of 1865 it was the more than 3,000 volumes belonging to the Beaufort Library Society that were lost, rather than "the library of a Beaufort, South Carolina, home." These books, mainly scientific and historical, were stored in members' homes following a fire that destroyed the library building in 1854. They were removed to Beaufort College in 1857.

The U.S. Government intended that the Smithsonian safeguard them until they could be returned to Beaufort following the restoration of peace. Beginning in 1890, a number of resolutions were introduced in Congress directing that "an equivalent in books, both in number and in value," replace the lost library, but nothing came of them until 1940, with the passage and signing of a bill directing it be done. The Beaufort County Library received payment for the Society's collection in 1950.
Roberta VH. Copp
South Carolina Library Heritage Project
Columbia, South Carolina

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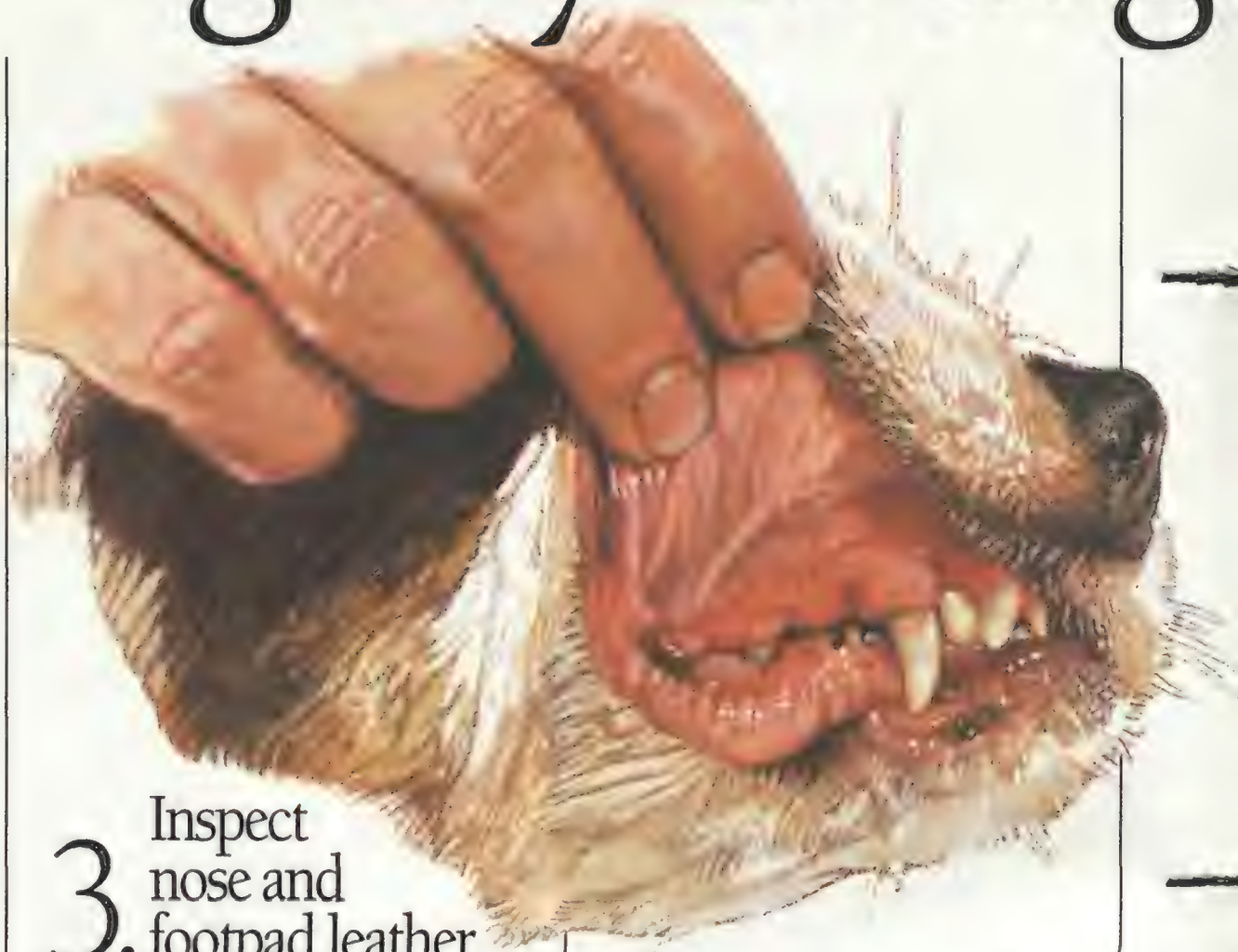

1. Examine mouth.

Raise your dog's upper lip to view the teeth. Are they:

A. Clean, white and glistening. 15 pts.
B. Yellowed with signs of residue. 5 pts.
C. Decaying with evidence of tartar. 0 pts.

Like humans, diet plays a major role in canine oral hygiene. If you didn't check A, chances are you feed your dog a steady diet of wet foods, which can result in dental problems. Dry foods, however, help cleanse a dog's teeth and gums.

2. Check breath odor.

While examining the mouth, you may have noticed the animal's breath. Is it:

A. Unoffensive. 10 pts.
B. Foul. 5 pts.
C. Sour, or sweet. 0 pts.

Most supermarket dog foods are grain-based. If improperly processed, grain-based cereals ferment in your dog's intestines and cause gas. In addition, many of these brands add onion and garlic to enhance the flavor. Unpleasant mouth odors can arise from indigestion. Sour odors may result from vomiting, and sweet odors may indicate diabetes.

3. Inspect nose and footpad leather.

Feel the tip of your dog's nose. Is the skin:

A. Tough yet pliable, with a slightly moist appearance. 15 pts.
B. Stiff, crusty or dry. 5 pts.
C. Very hard or cracking. 0 pts.

The nose leather of a healthy animal is clean, smooth and resilient. Similarly, footpad leather should be smooth and tough, yet pliable. In contrast, nose or footpad leather that is dry or cracked may suggest a diet lacking essential nutrients and fatty acids.

4. Examine stool.

Stool size and consistency are good indicators of a dog's overall well-being. Is it:

A. Small and firm. 20 pts.
B. Large and hard. 5 pts.
C. Large and excessively soft. 0 pts.

Stool volume is largely influenced by undigestible foods and enzyme deficiencies. While small, firm stools are easier to clean up, they also demonstrate your dog has properly assimilated all the crucial dietary nutrients.

Stool consistency indicates the quality of your dog's source of nutrients. Stool from a poor source may be soft. A hard stool can represent a mineral or fiber imbalance.

supermarket pet food, this spot quiz.

5. Feel skin and coat.

Thoroughly comb your fingers through your dog's hair in the opposite direction it lies naturally. Is it:

A. Healthy, vibrant and free of flaky deposits. 20 pts.

B. Dry, lackluster and poorly elastic. 5 pts.

C. Excessively oily, smelly with uneven growth. 0 pts.

There are normal variations in different breeds of dogs at different times of the year. However, poor nutrition always adversely affects skin and hair. Dogs that exhibit healthy skin and hair eat a diet with the proper balance of fats and protein, vitamins and minerals.

6. Evaluate muscle tone.

Feel along your dog's front shoulders and hindquarters. When compared to other dogs of the same size or breed, are the muscles:

A. Large and firm, yet supple. 20 pts.

B. Medium and soft. 5 pts.

C. Small and weak. 0 pts.

Good muscle development is directly related to physical activity and protein quality and quantity. Dogs that score high eat meat protein foods and follow a regulated program of feeding and exercise.

If your dog scored 95 or less, don't just change dog food, change where you buy it.

All dogs have dietary requirements that demand quality sources of protein. And meat best meets those requirements.

However, many leading supermarket dog foods rely on grains for their main source of protein.

Iams dog food isn't sold in supermarkets. It's sold only in pet shops, pet supply stores and feed stores. Sold by veterinarians, breeders and pet specialists. People who understand a dog's nutritional needs. And that's why they recommend Iams.

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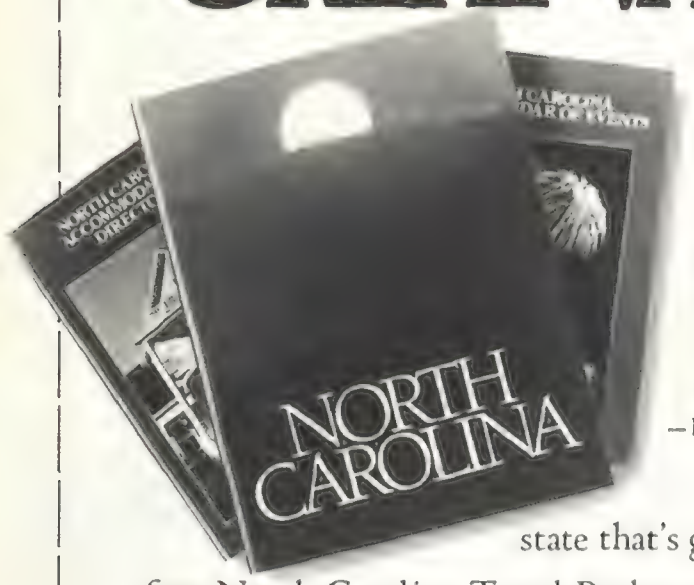

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Around the Mall and beyond

Driving alone at night, I sometimes fantasize myself as Mike Hammer: 11:30 P.M. Rainy. Cold. I swerve into a parking lot outside the fly-specked window of an all-night coffee-and-doughnut joint. I button up against the rain and bang open the door.

In the glare of neon, a waitress in unlaced Nikes slops coffee in front of me. And two men large enough to play defensive tackle and tight end for the Washington Redskins look up at me with tiny bloodshot eyes.

The truth is, Mike Hammer I ain't. I gulped my coffee and got out of there with still a half-hour to kill in the black, wet chill before *Voyager*, the National Air and Space Museum's newest historic airplane, was to be trucked from the Paul E. Garber Facility in Silver Hill, Maryland, to the Mall.

Not a hurricane, not wild horses and not the Redskin defense could have kept me away that miserable night. For I have a special feeling about *Voyager*, the strange, spidery, delicate aircraft that, in December 1986, flew nonstop around the world without refueling.

I first met this plane when it was little more than a sketch, a concept in the mind of the innovative designer Burt Rutan and a dream of his brother, Dick, and of Jeana Yeager, Dick's copilot, who is tiny in physical size but huge in skill and courage.

I saw it partly built and Jeana let me touch a wingtip—smooth and purposeful as a surgeon's scalpel. I watched a test flight, seeing the 100-foot wings droop as it began its run and then, as speed increased, gradually lift in a wonderfully human gesture of supplication—seeking flight.

Of course I sweated out the epochal

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flight: the loss of the wingtips due to the same sag and three and a half tons of fuel; terrible weather; the misread rate of fuel consumption. Glitch after glitch.

But Dick and Jeana and *Voyager* had pulled it off and the Smithsonian had a new national treasure. Its wings were already in the museum. The midsection—pilots' nacelle, canard wing and middle of the main wing—would be moved tonight. No way would I have missed witnessing this final six-mile voyage!

Back at the facility, the truck was ready. Wingless *Voyager* was secured on the flatbed—padded, chocked, lashed down. Warning lights glowed. A sign said "Wide Load." Red flags hung listlessly in the black rain. The schedule called for the trip to begin at midnight. Ten minutes to go. But nothing was happening.

I talked to technicians, truck drivers, television crews and a few Smithsonian staff members who lacked the sense to stay indoors. I dropped in at the dimly lit "showroom" of the facility to check up on old friends like Roscoe Turner's sleek RT-14, winner of the '38 and '39 Thompson Trophy, and the chubby little Martin Kitten, which only ever got about four feet off the ground.

Midnight came and went. "We have to wait for the Washington police to spring loose a patrol car for escort once we cross the state line into the District of Columbia," explained a Smithsonian authority who seemed to be in charge.

I felt a small uneasiness. Ten more minutes went by. The rain picked up. "We're waiting for our Maryland state trooper," said a Garber Facility technician who seemed to be in charge. "The one who escorts us to the District line."

Half-past twelve. There was a cold wind behind the rain. "Our trooper had to get a tankful of gas," said a truck driver who seemed to be in charge. "He was running out of *gas*. How about that?"

Just one more glitch. I climbed into my car, started the engine and turned on the heater.

It was about 1 A.M. when the trooper arrived, a pleasant young man in a big car that smelled of overflowed fuel. Rain guttered off his Smokey Bear hat as he inspected the truck, checked licenses and told the pickup truck and van drivers where to take up their positions.

I wanted him to say something dramatic like "This is it, people. Move 'em out!" But he got back into his nice warm patrol car and headed out of the Garber

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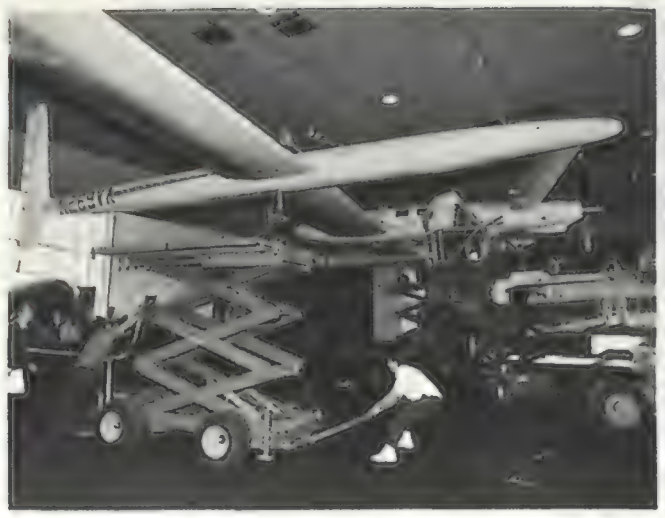

Lifts are moved away as *Voyager* is hung after a midnight trip through town.

driveway and onto the road. Two vans followed him, side by side. Then the truck inched carefully out behind the vans. After it, came two more vans and behind them, forming a V, came a pickup truck.

Realizing that I really didn't belong in the cavalcade, but determined to join it anyway, I slid into position on the right rear of the pickup and tried to look as official as possible—blinking emergency lights, ID badge up where everyone could see it.

We moved off, hit a stoplight, waited for it to change and then turned onto the main road. Immediately the gremlins struck again. As the truck turned, the nose of one of *Voyager*'s twin booms aimed directly at one of those highway signs that tell you that you're on a divided highway and had better keep to the right. The truck couldn't continue without destroying the newest and one of the greatest icons of the Air and Space Museum. Talk about a glitch!

One of the van drivers solved it neatly by jumping out in the rain and bending the metal sign out of the way. I haven't checked it since. Undoubtedly it's still bent out of the way.

We rolled on. How fast? Too slow for my speedometer to register. Cars piled up behind us, honked, tried to pass, saw the trooper's flashing dome light up ahead, and fell back.

We turned onto Pennsylvania Avenue, noted, out here, for a lot of stupid traffic lights. We shot through them at our 14 miles per hour. One frustrated driver, waiting for us while his light turned green, blew his horn at me as I went by. I looked at him imperiously and flashed my ID card, no doubt impressing him.

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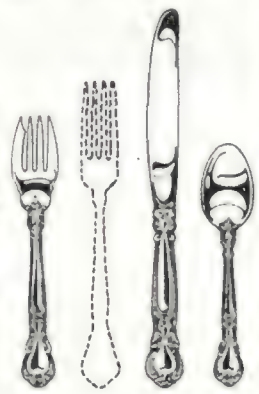

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patrol cars waited. They rode our flank, pulling into intersections, lights blinking, to let us slide through, then catching up again. We made better time. I caught a glimpse of 18 mph once, on my speedometer. We were on a downgrade.

At 1:30 we crossed the Anacostia River. The Capitol dome loomed ahead as we pressed on along the avenue, deserted except for an occasional late reveler tottering along the sidewalk.

At 1:45 we paused outside the National Air and Space Museum, blocking traffic on Independence Avenue while the truck backed across the sidewalk and onto the west pavilion. I parked with glorious illegality and rejoined the action just as the glitches returned.

First the center of the flatbed got hung up on a hump in the pavement. We stared at it. Someone went after a forklift, but it was out of fuel. At last two more showed up and eased just enough weight to get us past the obstacle.

Next the experts unlashed *Voyager* and the forklifts held it up with cables while the flatbed was driven out from under. Men shoved dollies under each of the three wheels, and the forklifts lowered the plane onto them.

Gently they pushed *Voyager* toward the huge west door of the museum, which visitors see as a glass wall, but which occasionally opens wide to be fed a new goody. The plane went in sideways, so tight a fit that you couldn't walk between wing stubs and inside wall.

So tight a fit, in fact, that the front wheel came up against the platform on which the Navy Hellcat sits—the F6F of World War II. To retract that wheel, we had to lift *Voyager*, and the cherry picker wouldn't start because of the cold weather. Another one was found, rolled into place and the wheel was retracted.

Push again. No one was heaving on the main wheel dolly that had yet to cross the threshold. I had meticulously kept my hands off this precious acquisition up to now, but someone had to shove, so I laid hold of the strut and heaved at it, and pushed at the wing spar, and hit the dolly with my foot—and it clunked across the doorway into the front foyer where its wings were reattached and where it now hangs.

Driving home a little later, I thought about the feel of the plane, about the whole evening. Not every day do I get to kick an icon.

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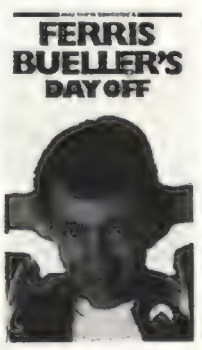

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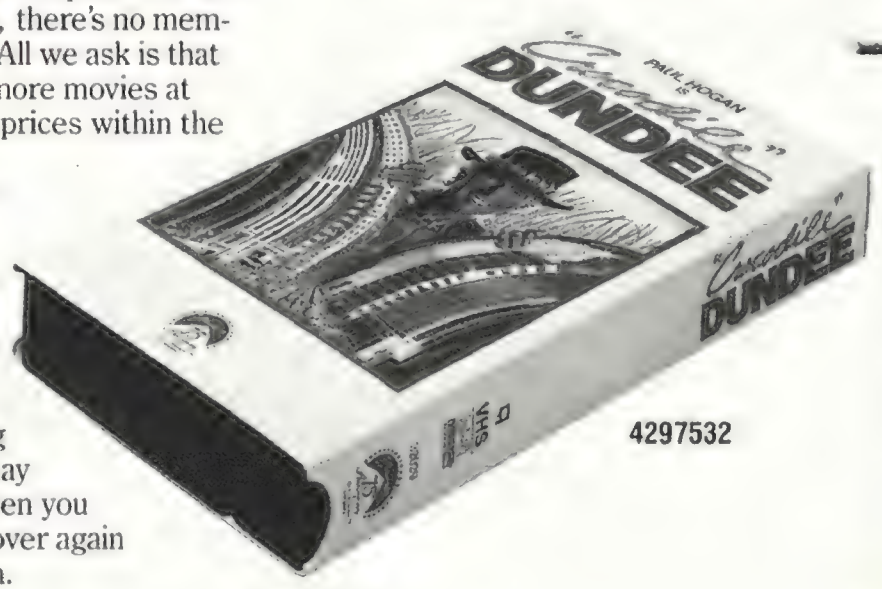

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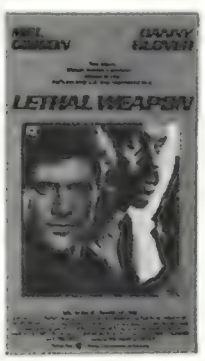

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Phenomena, comment and notes

Landscape painters of the past century saw what was coming; we could use a little of their artistic insight today

Life is full of threads that can be followed across time and space so that the personal universes in which each of us lives grow larger and larger. They can appear anywhere and lead anywhere. All that is necessary is to notice them and decide which to pick up and follow. For me the latest thread was the cover of an issue of the *Journal of the American Medical Association* (*JAMA*) last fall. The editors there use works of art on their covers, with a one-page commentary inside. For this issue they chose Frederick Church's *Morning in the Tropics* (p. 40), a scene along a South American river in which you can feel the sun through the mist and hear the birds. Even reduced from its seven-foot width to the confines of the *JAMA* cover, the painting is so alive that the viewer is drawn in deeper and deeper until finally transported from the workaday world of 1988 to an unblemished paradise of 110 years ago.

Now, I'm one of the happy Philistines who don't know much about art but know what they like: I've carried my Winslow Homer prints from house to house for 35 years. I do know enough to understand that even if the scene in Church's painting were literally real, no camera could produce *Morning in the Tropics*. I understand Lewis Mumford when he writes: "Art at its best discloses heretofore hidden meanings. It tells more than the eye sees or the ear hears or the mind knows. . . .With the aid of the symbol, man not merely remembered the vanished past: he took in the emergent or the potential future."

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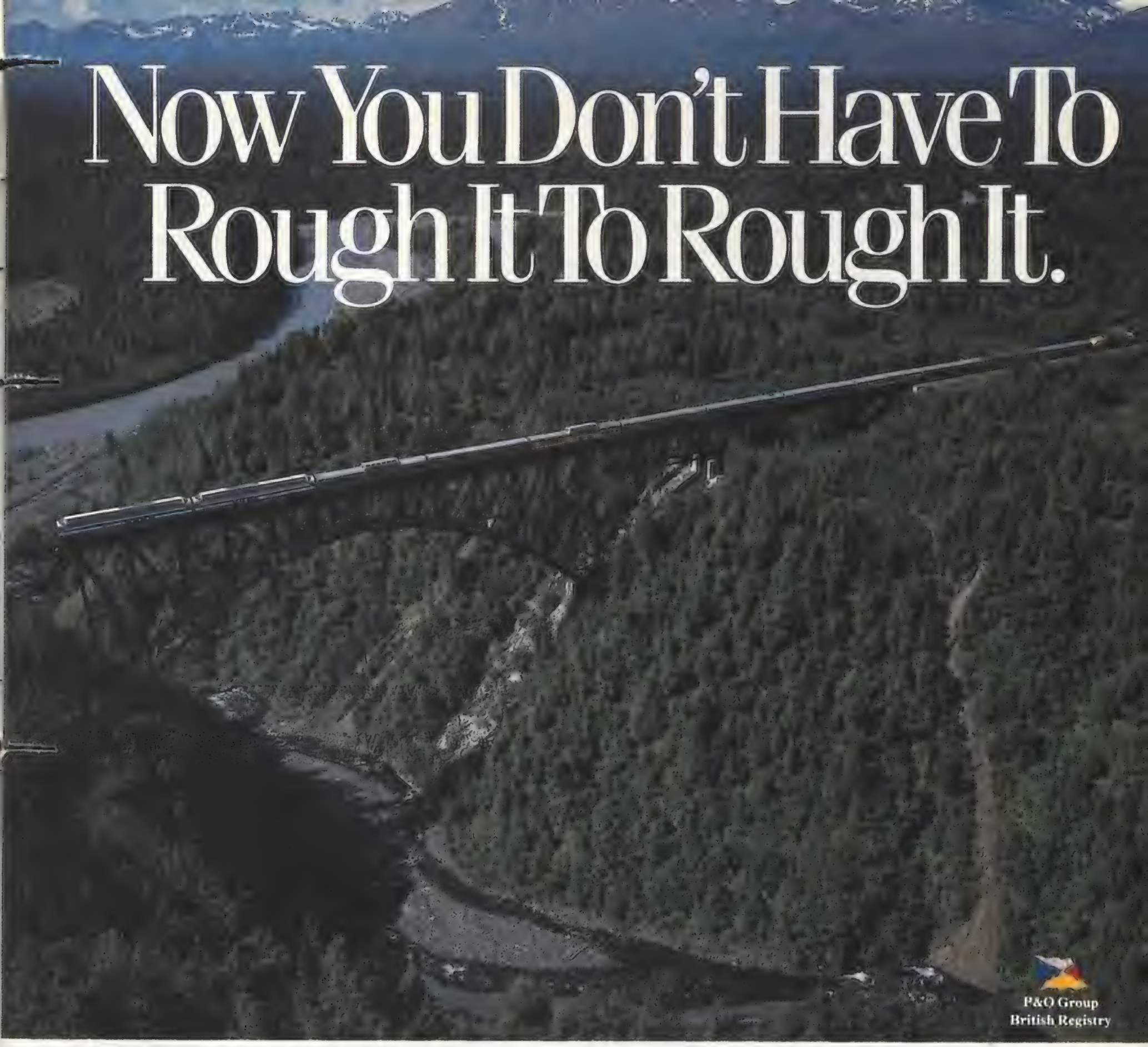

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In Frederick Church's *Morning in the Tropics*, canoe in the distance may have been the artist's premonition of destruction.

Okavango Delta in the Kalahari Desert, Botswana.
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CELEBRATE THE ENVIRONMENT. NOT POLLUTE IT.
The new National Geographic Specials: African Odyssey—January 20th.

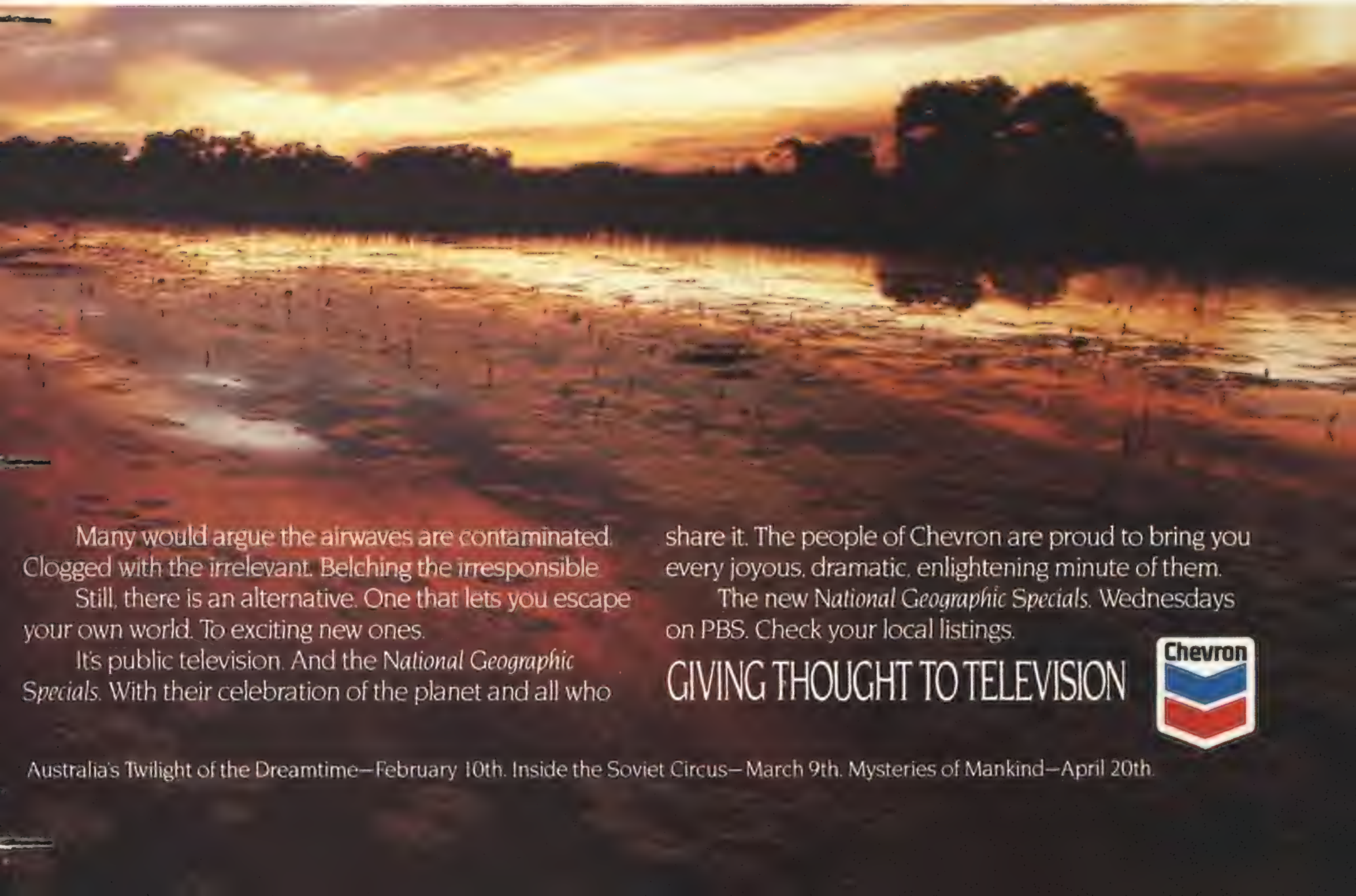
But there is so much to know, so many surprises, so many unexpected connections. Donna Mann, a lecturer at the National Gallery of Art, wrote the *JAMA* commentary for *Morning in the Tropics*, which has as many threads per paragraph as anything I've read lately. Church was a scientific painter in the sense that he studied the natural sciences and knew the geology and the botany of the places he captured. He had read Alexander von Humboldt, the German naturalist, and followed his urging to see for himself the natural wonders of the world, to combine discovery and science with art. Whereas artists like Thomas Cole painted generic scenes from memory, Mann explained to me later, Church rode his donkey into the jungle and made lots of detailed sketches before actually going to work on the paintings themselves.

What really brought me up short in Mann's commentary on *Morning in the Tropics* was her focus on a human figure in a canoe in the distance, barely visible in the painting itself and even less so when reduced in a magazine. She wrote: "... the disillusioned artist may have been sounding an ominous warning that even in this unspoiled paradise, man's very presence in the wilderness, however unobtrusive, carries with it the seeds of nature's destruction." I had always thought of the Hudson River School of painters, of which Church was a leading light, as celebrating the glories of the natural world; only now was I finding out that they were painting eulogies as well. Church's *Twilight in the Wilderness* is not just a day ending in a blaze of color reflected in a beautiful mountain lake—it is also an era ending.

Flipping through back issues of SMITHSONIAN, I looked again at the Catskill gorges of Thomas Cole, the hallucinatory Rocky Mountains of Albert Bierstadt, John Kensett's capture of light from sea and lake. I walked through the National Gallery and the National Museum of American Art. I bought *American Paradise: The World of the Hudson River School*, the book published in conjunction with the exhibition of the same name at New York's Metropolitan Museum of Art, the first full-scale show there of this school's work in 70 years.

Now the paradox is plain. In nearly all of these paintings, the people are small, often so tiny that at first you do not see them at all. Nature is all-powerful and humans are weak to the point of impotence. *Cotopaxi*, a Church rendering of the erupting, 19,000-foot volcano in Ecuador, looks at first like the beginning of time: a harsh world is bathed in the red glow of sun shining through smoke. Only after a long time do you notice birds flying along a cliff far below you, and only after that will you see, if you look sharp, the tiny figure of a human being. And yet it is the people who will destroy nature. Once you know the code, you start looking for the stumps that signify the destruction of that world, one tree at a time. As Mann pointed out, artists in Europe had ancient ruins to paint—their American counterparts had the stumps of a disappearing wilderness.

The Thomas Cole painting on the cover of the Met book says it all. Known as *The Oxbow*, its formal title is *View from Mount Holyoke, Northampton, Massachusetts, after a Thunderstorm*. You the viewer are high on a steep hillside, looking across the river at cleared fields and


Many would argue the airwaves are contaminated. Clogged with the irrelevant. Belching the irresponsible
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small villages. The hill itself, however, is still a wild place, uncut mixed-growth forest of the type that once covered the Eastern Seaboard. Just down the hill is what looks like a closed beach umbrella, put there for shade. But you really need someone like Donna Mann to point out to you the artist himself, nearly hidden below some rocks, working at the boundary between the works of nature and the works of Man.

Printed laments I know too well. Aldo Leopold, who died in 1948, wrote in *A Sand County Almanac*: "We are remodeling the Alhambra with a steam shovel, and we are proud of our yardage." Archie Carr, the great sea-turtle biologist and conservationist who died last year, once said the destruction going on today "is just a lot of little clean-up operations, little scratchings-out of small tag-ends and patches of the past overlooked in the first waves of ruin."

I find myself wishing that landscape painting was still taken seriously, still considered art. Imagine two paintings side by side, both of the delta where the Colorado River empties into the Sea of Cortés. One would show it as it was in 1922, when Leopold and his brother camped there for three weeks: endless green lagoons where bobcats fish for mullet from half-submerged logs while avocets and egrets feed in the shallows; mudflats where deer fatten on mesquite pods and wild melons. The second would show it today, a trickle of dirty water soaking into the sand before it touches the sea. Birds, animals, trees gone. Perhaps it would be art if somehow the two images were superimposed.

Or how about a closeup of a bulldozer blade at work? On one side, the gleam of scored, scoured steel, filling the canvas; on the other, in fluid motion, a rich stew of dark topsoil and mashed wildflowers, broken bird's eggs and decapitated box turtles, dismembered beetles and legless spiders, worm fragments and the leg of a mouse?

Landscape artists today tend to be dismissed as Sunday painters. But the Hudson River painters of the past century still have a lot to tell us, as I am so belatedly finding out; I suspect the same could be true for anyone who climbed onto today's equivalent of a donkey and rode away from civilization to tell us "more than the eye sees or the ear hears or the mind knows."

John P. Wiley jr.

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In 1937, Amelia Earhart and her navigator, Fred Noonan, began an around-the-world flight. Somewhere in the vicinity of Howland Island in the mid-Pacific, she radioed "Position Uncertain." She was never seen nor heard from again. Although various speculations have arisen about her fate, it is generally accepted that she and navigator Noonan went down in the ocean near Howland Island on July 2, 1937.

To observe the 50th Anniversary of Amelia Earhart's disappearance, the United States Historical Society has created the ***Amelia Earhart*** doll. Crafted of the finest bisque porcelain and authentically costumed in a vintage-1935 aviator's costume, the doll is the First Issue of a landmark collection, "American Women of Arts and Letters."

The ***Amelia Earhart*** doll commemorates the indomitable spirit and the unsurpassed achievements of one of America's greatest heroines. In her short lifetime, she was the:

- First woman to fly solo across the Atlantic;
- First person to fly solo across the Pacific from Honolulu to California;
- First woman to make a transcontinental non-stop flight;
- First woman to receive the Distinguished Flying Cross.

In addition to her considerable accomplishments in the aviation field, Amelia Earhart worked successfully as an author, a professional photographer, a nurse, and a social worker. She was a fashion designer for women's magazines such as *Vogue, Harper's Bazaar, Vanity Fair,* and the *Woman's Home Companion.* She also served as aviation editor for *Cosmopolitan* magazine.

Amelia Earhart has been called "the last of America's great heroines." Along with fellow aviator Charles Lindbergh, she symbolized something daring and hopeful in the human spirit.

The ***Amelia Earhart*** doll is the first issue in a landmark collection of "American Women of Arts and Letters." Each doll is numbered and registered in the Archives of the United States Historical Society in Richmond, Virginia. Researched, sculpted, and costumed by eminent historians, artists, and doll authorities, each of the 12 dolls is a masterpiece in a 1":1' scale.

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Like a three-foot-tall extraterrestrial, the GM entry causes a stir during trial spin on a California street.

By William H. Jordan jr.

Powered by sunlight, alien autos test themselves for 1,950 miles

An earlier, identical version was tested in Arizona before both were shipped to Australia for the race.

In a race across Australia, run to prove that solar-powered cars really do work, an entry designed by Paul MacCready won going away

In the hot, hazy, mirage of the distance, the lights shine like a cluster of suns. The sun itself is 10:30 high and sizzling hot, but the lights still dazzle from more than two miles away. Photographers and spectators line the road. The lights grow brighter, larger. Headlights, obviously, mounted on an enormous truck that now looms out of the heat, expanding, shimmering. The tractor is hauling a train of three gigantic trailers, the entire procession hurtling at 70 miles per hour.

Then, coming from behind us, moving toward the oncoming truck, glides a strange, flat vehicle about 20 feet long and 6 feet wide. The cockpit is a streamlined lump behind the broad, crescent, leading edge, and the body flares out behind into a glinting, blue-black panel. The windscreen lies flush with the surface of the lump like the vacant eyes of a giant, prehistoric arthropod. With a quiet, electric buzz it heads for the truck and those blinding headlights.

Sun cars endure a trial by road-train

A second vehicle follows. As strange as the first, it's also very different. The body of this one suggests the fuselage of a small airplane on four wheels. Instead of wings, however, it carries overhead a flat panel about the size of a Ping-Pong table. It appears to be covered with small, rectangular scales, and glints with the same metallic, blue-black sheen as the surface of the first car.

Binoculars rise to the eyes of spectators. Instantly the truck is huger than life, the headlights more intense. The strange vehicles seem to grow smaller as the truck expands. Everything shimmers and wobbles in the rising heat.

The first vehicle reaches the truck and begins passing along its length. The small, frail craft holds steady, unaffected by the backwash from the behemoth. The second vehicle takes its turn. It passes the first trailer and its overhead panel begins to flutter up and down. It meets the second trailer and starts swaying from side to side. At the third trailer, the vehicle literally bucks. Its wheels lift clear off the ground and bounce down. It lurches from side to side, the driver fighting to stay on the road as it clears the trailer. Twenty-four of these odd machines will have to pass this test before the day is done. All must prove capable of surviving Australian highways and their legendary road-trains.

We had waited for three days, photographer Peter Menzel and I, for the start of these trials. We had sweltered in the boiler-room heat of Australia's north coast, breathed the clinging air and groped around the spread-out town visiting the various racing teams as they tuned, tweaked, repaired and, in some cases, reconstructed their vehicles. The event was the first World Solar Challenge, a marathon for solar-powered cars, from Darwin down through 1,950 arid, isolated

Photographs by Peter Menzel

miles of Australian outback to Adelaide on the southern coast.

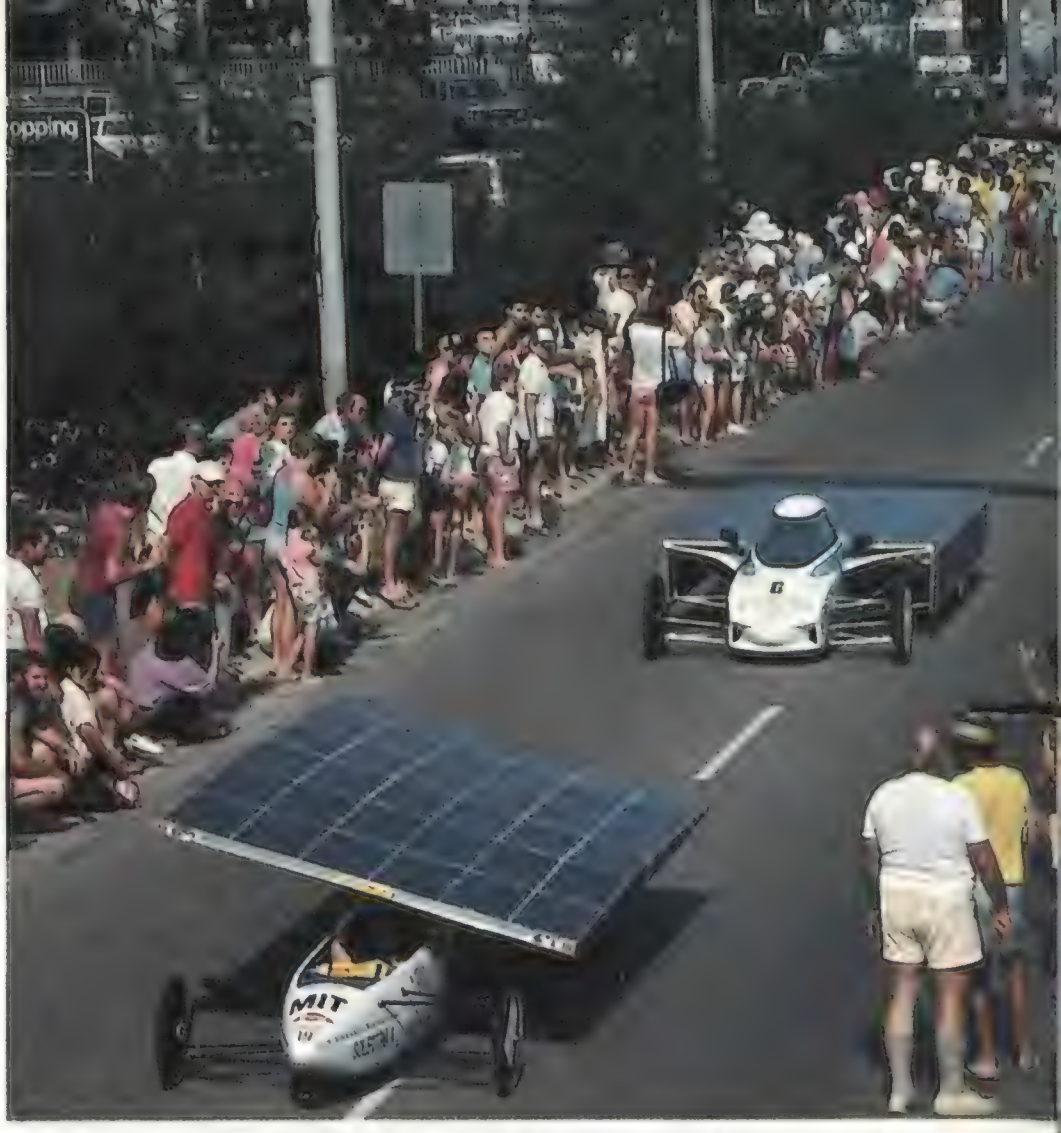
It was a strange race with an altruistic motive: to spur the development of solar power. It had been conceived and organized by Hans Tholstrup, a Danish-Australian adventurer who once flew a small plane around the world single-handed. Later in his career he became obsessed, he says, with energy-saving and alternate-energy technology. What better way to stimulate technology, reasoned Tholstrup, than to give an international race.

Teams had come from West Germany, Pakistan, Japan, the United States, Denmark and Switzerland as well as from Australia. Three local high schools were competing, along with colleges and universities, and corporations like Ford Motor of Australia, Nippon, Mitsubishi and General Motors.

Rarely in this age does one find characters like the ones who gathered in Darwin, including specimens of that rarest of all breeds, the successful idealist. One was Paul Mitchell, founder and president of John Paul Mitchell Systems, a manufacturer of hair-care products. An ardent environmentalist, he owns and operates three organic, solar-powered farms in Hawaii. His vehicle, the *Mana La* (in Hawaiian, Power of the Sun), was designed to use the wind in addition to solar energy, and with its Conestoga-like solar panel arching over a needle-sharp fuselage it somehow suggested a hair blower (p. 58).

There was Dick Smith, a wealthy businessman, adventurer and Australian of the Year for 1987. Smith had once parodied Evel Knievel by jumping a double-deck bus over 17 parked motorcycles. He was here to drive his own entry, called *Team Marsupial*. And there was Harold Clisby, a 75-year-old manufacturer of air compressors. Along with his 17-year-old son and two daughters, 19 and 21, he was entering a solar-steam car which had been trailered here behind a double-decker owned and operated by the Hell's Angels. D. Schmitz, dubbed the Suitcase Man, had arrived from Germany with his vehicle stored in three pieces of luggage. He sat down at the airport, assembled his entry on the spot and drove away.

Ultimately, however, the prerace buildup revolved around General Motors. The American company had started from scratch only seven months before (in con-



At the start, the middle of the pack rolls out of Darwin, moving here at about 12 miles per hour.

Some contenders (from left): Rolf Disch's German entry dropped out after eight days. *Just Magic* didn't live up to its name. The car at center was built by the Chisholm Institute of Technology in Melbourne;

The MIT car is at lower left, followed by an entry from Japan. The first cars were already far ahead.

trast to many of the other teams, which had worked on their entries for up to two years). General Motors was rumored to have spent more than $3 million on its *Sunraycer* and obviously intended to win.

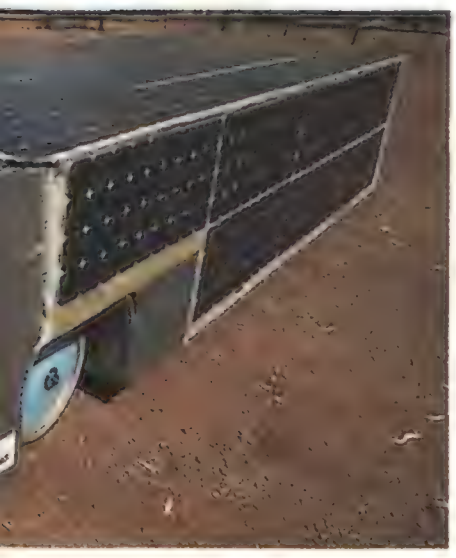
Most of the teams, unlike GM, had worked under limited budgets. Three Pakistani college students had entered their *Solar Samba* at a cost of $5,600, partly to demonstrate that even in poorer countries solar power could be made economical. Twenty members of the Crowder College team had paid their own way from Neosho, Missouri, mainly because each believed in the cause of solar transportation. These teams worked side by side and developed a friends-at-arms camaraderie, sharing tools, exchanging parts, nurturing a certain resentment of General Motors despite the fact that it was rated in the "commercial class."

Feelings aside, the General Motors car represented a radically different approach to solar car design. Discarding the separate, bulky overhead panel, GM had glued the solar cells directly onto the streamlined exterior to reduce drag.

Philosophical as well as technical questions were at issue. Would altruism and individual initiative prove stronger than professional organization and big money? Paul Mitchell, speaking for many of the solar car fraternity, said: "We feel that the large companies have just paid lip service to solar power and don't really have the technicians on staff. What they do when they want to compete is employ someone to make them a vehicle." Was he right? Beyond all else, the question was: Would the race and the technology of anyone, Pakistani students or General Motors, prove the solar car a practical device?

Sunday, 5:30 A.M. Light is just beginning to glow in the eastern sky. Two flying foxes flop homeward with that mothlike gait peculiar to bats. They float under the pink bellies of a few scattered clouds. The temperature reads about 80 degrees F as we drive to the starting line at the Casuarina Shopping Square (left).

The road tests were completed yesterday. The MIT car caught fire when the driver's seat shorted out the batteries, but the driver was pulled out after losing only the hair on the back of his head. The Crowder College team broke a front wheel, quickly repaired, and Dick Smith's car overheated, which caused the batteries to spill acid. General Motors won the pole



the driver sat in pod at left in picture. Solar panel on the Australian Ford racer could be tilted toward the sun. A Swiss contestant, the *Spirit of Biel*, was photographed on a boat ramp before the race began.

Racing in cars that run on sunlight

Using a very nonsolar, gasoline generator, one crew member gets in a spot of sunrise ironing on the road.

position with a test speed of 70 mph. Mitchell's car took second at 57 mph. *Southern Cross,* a Japanese car, and *Just Magic,* entered by Good Wood High School in Adelaide, went so slow that their velocity did not register on the radar gun.

6:30. The cars are arriving and are being pushed to their positions in the starting queue. The sun glints off their solar panels, which even now are silently converting sunlight to electricity. It seems a miracle that certain forms of silicon as well as substances like gallium-arsenide can produce electric current when struck by light. In these cars, current from the solar cells is distributed to the motor, the battery system or to both. The batteries are the key, however. They supply extra power while the car is passing, climbing hills, being shaded by clouds, or driving in the weaker light of early morning and late afternoon. The batteries also add weight, more than 60 pounds in most cases.

7:30. People are gathering. A breakfast truck has been set up, offering greasy eggs, bacon and toast. A Dixieland band adds to the festivities. Already the heat is oppressive. Banners hang limp around the starting area.

8:30. Police are holding back the crowds. Race crews fuss and fidget. One group tries frantically to install a new drive chain, which appears too short. Mitchell and his entire crew hug in a big mass, form a ring around the *Mana La,* link hands and chant.

The Hell's Angels' bus leads the way

8:55. The speeches have ended. The crowd lines Vanderlin Road, down which the cars will race to the Stuart Highway. The minutes pass. Then motion. The first vehicle is not the *Sunraycer* but the Hell's Angels' bus. It pulls a trailer with Harold Clisby's solar-steam car, which just didn't work; as a gesture to a fallen comrade, Tholstrup is giving him this honorary lead under the sun. Scratch one idealist—one cantankerous, wishful, grand old individualist.

The true start begins. The GM car glides by with a hiss. Behind in the staggered start comes Mitchell's *Mana La, Team Marsupial* driven by Dick Smith, Ford of Australia, the Swiss car, the Chisholm Institute of Technology's car, *Desert Cat,* from Melbourne. They proceed by in single file, off to the great outback. Eighteen more follow.

Menzel and I wait until the last entry, the Japanese *Southern Cross,* crawls past the starting line, then we begin to play catch-up in our Toyota Land Cruiser. Two and a half miles out we find one of the Japanese cars *SVO 2R*—pulled over. We pass *Just Magic,* traveling 17 mph. Nine miles out we overtake the Warragul Technical School team. Its car's drive chain has jumped off, but they "expect no more trouble until Adelaide."

The General Motors camp offered television and telephones as well as catered meals and drinks.

An official observer, required by race rules, beds down for the night next to *Team Marsupial* entry.

As we travel on, the landscape changes. Small palms and eucalyptus of the seasonal rain forest give way to an arid savanna with scrubby eucalyptus scattered across fields of spinifex grass. The road climbs into mountains with rugged, dry cliffs. It is 106 in the shade, but now at least the heat is dry.

At 53 miles we pass Rolf Disch in *Lichtblick 2*, going 36 mph. At 68 miles, Dick Smith is going 18 mph up a hill. Clouds are building up—big, puffy clouds that cast black shadows. The solar cars slow down as they pass underneath.

Eighty-three miles from the start we come up on *Mana La*. It is going uphill at 40 mph, and while this is phenomenal for a solar car, it has to be drawing from its batteries because *Mana La* is a heavy vehicle. Under the best of conditions, only so much sunlight falls on the solar panels, which means only so much current can be generated—hence a maximum speed using cells alone. Going uphill this speed is much less than 40 mph. One critic has predicted that *Mana La* will drain its batteries too soon.

At 92 miles we finally catch the *Sunraycer*. A station wagon with a sign on top warning "Caution: Convoy Ahead" marks the rear of the GM entourage. We pass a large camp-outfitter's truck, a supply bus, a traveling workshop and a four-wheel-drive vehicle named *Porcupine* bristling with 11 antennas. It's the communications vehicle. Ahead of *Porcupine* is the observation motorhome where the GM tacticians monitor the *Sunraycer*'s vital signs. Several hundred yards ahead is another car, an advance guard, with flashing lights mounted on top. A scout car stays 5 to 30 miles in front of the convoy, providing reports of road and weather conditions. *Sunraycer* is about five minutes ahead of the *Mana La*.

1:35 P.M. The town of Katherine. A crowd has gathered at the BP Road House where all the racers must pull in for an official "press stop." A General Motors team has set up a portable barrier, and as the *Sunraycer* approaches and enters the enclosure the crowd cheers. The pit crew, each with an assigned job, crowd around, raise the canopy and inspect the car. A new driver climbs in. Seventeen minutes after the *Sunraycer* leaves, the *Mana La* comes into the press stop.

Now the country flattens out. The heat is torrid but dry. The grass is dry. The trees are dry. Termite mounds become a dominant feature of the landscape. One species builds a tall, slender spike of a mound like candle drippings; a second shapes heavy, lumpy mounds like outrageous piles of ice cream; a third produces shapeless lumps around the bases of trees; and a fourth constructs "cathedrals" at least 15 feet high. They are everywhere, by the millions.

A dead cow lies next to the road. Several miles later, a dead water buffalo. As we drive, the toll mounts: 10, 15, 25. Some are nothing but skeletons. Others are mummified corpses, skin over ribs like rags over rafters. Some are much newer, bloating. Apparently, they are never removed.

Road-trains cause most of this carnage. The famous Australian road-train is a truck tractor hauling three enormous trailers at a time. It is 130 feet long, has 72

A biologist by training and a writer since 1975, William Jordan is at work on a book about what the study of animals can tell us about the human mind.

wheels, weighs 120 tons and carries six huge headlights. Welded onto the front of the cab to protect this leviathan is a "roo bar"—a grating of six-inch-round steel pipes. A road-train stops for nothing, except possibly another road-train, partly because it's difficult to stop 120 tons, partly because to attempt to stop quickly can cause the trailers to jackknife.

In the days to come, the *Sunraycer* will pass many oncoming road-trains, a tiny, frail insect skittering past dinosaurs. In those brief moments, two philosophies pass in the sun, one a technology based on petroleum, rushing toward extinction, the other a technology wedded to the surrounding world, taking what's offered, learning to use it.

Ford team has removed the solar panel to give it optimal tilt during morning battery-charging period.

5 P.M. By the rules of the race, the sun cars must now pull over and stop, wherever they are. They can charge their batteries for the next two hours and again in the morning from 6 until 8, when they start. So, this is the moment when the crews pitch camp and orient the solar panels perpendicular to the sun. These are critical times for a sun car, a time for "filling the tank" with energy for the next day's travel; anyone who stands in front of a basking panel had better be ready for verbal abuse.

We have decided to spend the night with the General Motors camp, since they have facilities for traveling media, but we plan also to travel back and visit the camps of the nearest competitors. We drive back for almost an hour and encounter no one. No one responds to our radio. So we return to the GM camp and learn that the closest competitor is the Swiss team, 68 miles behind. Ford is next, 73 miles back, and the *Mana La* is 87 miles off the pace. Mitchell's Hawaiian team did in fact stop at 4:06 P.M. when the battery charge dropped too low.

All the comforts of home and then some

The GM camp is a thing of wonder. The company has hired a caterer to provide tents, cots, sleeping bags, portable showers and commodes, and meals for its members. Writers, photographers and film crews are also welcome. The camp includes a bank of pay phones and a satellite uplink dish. A generator supplies electricity for lights and television (p. 53).

Day Two, 5 A.M. We leave in the darkness to visit other camps. An hour later we encounter the Swiss team at Mataranka. Their goal now is to maintain their lead over Ford. Fifteen minutes after that, we find the Ford team, the panel removed from their vehicle and faced toward the sun. A cable is conducting precious current into the batteries. It turned out that because of a software malfunction, the Ford team started the race thinking the batteries were full, but they were actually at one-third capacity. In addition, their gear-change cable snapped at the starting line and they ran the entire first day stuck in third gear. Forty-five minutes later we finally encounter the Mitchell team. The *Mana La* is on the shoulder of the highway, 50 feet from a dead, bloated bull, while the team does everything possible to recharge the battery pack. A quartz crystal sits on the *Mana La*'s chassis to bring good luck to the solar-charging process, and the team leader informs us that as soon as they do get some wind, "Pphhtt—we'll be right up there." They have gambled on the wind and, despite the crystal, are becalmed, dead in the water.

Menzel and I spend the rest of the morning waiting for slower cars to come by, and then head off to catch

A family uses hats and an umbrella to provide shade from the tropical sun powering *Team Marsupial* car.

up with the *Sunraycer* again. The clouds, which have been building up, are beginning to suggest a storm, and as we speed south, the glory of the outback overwhelms us. The sky turns black, and here and there around the sweep of the compass columns of rain extend down to the horizon, pillars holding up the sky of creation. Where the water falls, life will spring up.

At 7:30 that evening we finally reach the GM camp and realize a decision will have to be made. We are 156 miles ahead of the Swiss, the nearest competition, and from here on we cannot cover the other cars and the *Sunraycer* too. For everyone else it is a race. For General Motors it is a demonstration—a demonstration it seems wise to observe.

When General Motors decided to enter the World Solar Challenge, it did so with the expectation of full-bore competition from Mercedes, Ford and the major Japanese auto companies. (Subsequently, only Ford of Australia entered.) GM joined the fray by putting together a team consisting of 16 of its divisions, its Hughes Aircraft Company subsidiary, and AeroVironment Inc. AeroVironment is headed by Paul MacCready, famous for the first human-powered airplane, the *Gossamer Condor*—and a solar-powered plane, the *Solar Challenger* (SMITHSONIAN, February 1981). AeroVironment's design studies dictated a highly streamlined body with integral solar cells, rather than a more traditional design using separate solar panels that could track the sun.

To the aerodynamic design, AeroVironment added the latest in lightweight parts and materials: an aluminum spaceframe chassis and the Kevlar-Nomex-Kevlar body. Consultants were brought in to design the electronics, wheels and brakes. The GM research lab developed the superlight motor; Chevrolet/Pontiac/Canada designed the suspension and steering. Hughes Aircraft designed and built the solar cells and silver-zinc batteries.

The car was put through its paces at GM's Arizona testing ground. When the glitches were ironed out, the GM team built a second *Sunraycer* for the actual race. (The original would be trailered along for parts.) The result was an effort worthy of a space probe and a machine that weighed just 390 pounds.

Jonathan Tennyson, a member of Paul Mitchell's *Mana La* team, checks wind velocity before day's start.

At the same time, AeroVironment and Holden's Motor Company, the GM Australian subsidiary, brought automotive racing experts in to devise tactics for the Stuart Highway. In May one team drove the whole route, videotaping the road as they went. They counted all the cattle grids (113). They measured the length and gradients of all the hills, took soil samples, noted the coarseness of the road surface. They studied the hourly weather data for the previous three years. With this information, the tacticians from Hughes and AeroVironment devised a plan. They decided to use extra power from the battery for the first 15 minutes of the race to open a comfortable lead, and to then drop back to the power level their computers found to be optimal for the day's conditions. The computers had already simulated road elevation and direction, the sun angle and the predicted weather.

Day-to-day operation came down to the crucial matter of battery management. The idea was to start the day with batteries full and end with them more-or-less depleted, depending on what weather conditions were expected that evening and the next day. This ensured maximum use of solar energy. A car would make up the battery deficit during the evening and morning charging times. It could also pay back the battery deficit while driving. Once the sun rose to a certain height and delivered enough energy to drive the car at 40-42 mph, any extra current could be shunted into storage.

So MacCready and the other tacticians rode behind the *Sunraycer*, monitoring the data telemetered back on battery charge, solar current, motor current, road speed and much more. They weighed this information along with factors like wind speed and direction, road conditions and cloud cover, to milk the maximum performance from their machine.

The desert as data on a computer screen

There is something odd about it all. There we are, riding in an air-conditioned bus, scrutinizing nature in the form of graphs and data on a computer screen. At one point the helicopter hired for filming and advance scouting radios, "We have a big red [kangaroo] off to the right." One of the tacticians raises his head to glance distractedly off into the scrub for a moment, then turns back to the screen.

A weather report comes in: we are running just ahead of the storm. The others are not so lucky. Hail has broken some of the Ford car's cells. Wind gusts have flipped the car from Crowder College over on its top, destroying a quarter of the cells; earlier the team stopped and donated spare cells to Rolf Disch, whose panel was disintegrating. The Swiss have encountered a raging flash flood and decide to float their car across on inflated truck tubes. But by the time they locate tubes the water has receded and they can drive their car across. The strategy of getting in front from the start, and the design, have paid off handsomely. From now on the *Sunraycer* will be bathed in sunlight; the others will labor under clouds and many will not finish the race.

As the fourth and fifth days pass, the GM entourage settles into a routine of marking time while rolling through the endless outback. Almost everyone regards it as barren waste. As a former biologist, however, I am simply astonished at what we overlook. At least ten million years old, the Australian outback has one of the oldest and most sophisticated arid-land ecosystems on the planet. The great irony is that over the eons the plants and animals have evolved solar adaptations that match those of this high-tech device scurrying toward Adelaide.

A three-foot-long lizard—a goanna—runs across the

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The Hawaiian car was designed to use the energy offered by wind, as well as sunlight, to make it go.

road ahead of us. It will descend into a burrow, lose its body heat and come up for more energy like a porpoise for air. Its legs act as heat exchangers, heating and cooling faster than the body trunk, and the blood vessels can be opened wide or constricted according to the body's need for hot or cold blood. Other lizards use the skin surface for vascular heat exchange (SMITHSONIAN, August 1987); in the mornings they sit atop mulgas and on other prominent spots, exposing themselves to the sun, just like the solar cars.

Knowledge like this gnaws at the subconscious as we drive toward the road mirage. The blue sky seems to have liquefied, dripped onto the road and flowed toward us. Around us for 360 degrees the mirage circumscribes the horizon, blurring the edges of the great platter of land, mulgas and other shrubs shimmering and wavering in the heat, in the incomprehensible deluge of solar energy—and suddenly it strikes me that this same land we are trying so resolutely to race across is really a gigantic solar panel. That same energy that drives the sun car also drives the plants up out of the ground. The energy captured in dead and living stuff drives the termites to build their mounds. The heat drives the ants to scurry frantically about their commerce, drives the lizards across the roads.

The rest of the race is no more than a formality. The *Sunraycer* crosses the line at the Seppeltsfield Winery in the Barossa Valley, finishing in 5½ days with an average speed of 41.6 mph. The next competitor, Ford, will not finish for another 2½ days, with the Swiss time 2½ hours behind that. The Swiss would have finished second, but they suffer a traffic accident in Alice Springs, for which they receive a ticket. *Team Marsupial* crosses 1½ days later. When the race officially ends 5 days after the winner has crossed the line, no other car has finished. Two cars arrive in Adelaide about a month after the start.

As GM president Robert C. Stempel congratulates *Sunraycer*'s team—and General Motors deserves great praise for raising solar vehicles into the space age, for demonstrating that solar technology does indeed have application—I cannot get the image of the Great Solar Panel out of my mind. This, I think to myself, is the point: the entire Earth is a solar panel. Fossil fuels are its battery, one that cannot be recharged, and when the fuel runs out, we will be forced back to the daily dole of energy from the sun, just like the animals, the insects and the plants. This is the reason men like Hans Tholstrup think up things like the World Solar Challenge.

Builder of solar-powered cars and airplanes, Paul MacCready appears to hold the sun in his hands.

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By Helen Dudar

The art world's boy wonder is now a mature master

At 50, British artist David Hockney has never been busier or more innovative; a Los Angeles exhibit gives him his due

Mr. and Mrs. Norman Pattiz

The Splash was inspired by a book on swimming pools. "A nice little subject . . . a splash," Hockney says.

It is a balmy autumn night in Hollywood, and high in the hills, David Hockney's studio is being prepared for visitors. The assistant working with him on set designs for a stage production of Wagner's opera *Tristan und Isolde* is touching up the model. Another assistant, whose duties include household chores, is setting out a dish of raw vegetables with dip and a plate of packaged cookies. The dog is scampering about, mauling a dog toy. Hockney, as is his habit when he is preoccupied, drops a cigarette on the floor and kills the ember with the heel of his bedroom slipper. The burn mark is hardly noticeable amid the rainbow of paint splotches on the vinyl tiles.

The studio, a vaulting skylit space built over a former paddle-tennis court behind Hockney's house, holds a rich clutter of work and the memorabilia of recent enthusiasms. At the far end are five office copiers on which, with considerable verve and wit, he has turned out what he calls his "Home Made Prints," an undertaking he accurately labels a revolution in art. There is also a paper shredder for discards, a prudent artist's safeguard against unauthorized reproduction. Along one wall is taped a life-size photocopy of a long Chinese scroll; the piece embodies Hockney's current obsessions with surfaces and the sterility of perspective in art, and was used in a short movie on which he has lately collaborated with a young filmmaker.

On the walls hang a couple million dollars' worth of recent Hockneys—at least 35 landscapes, portraits and still lifes completed during the past year, most of them never exhibited. A few of them depict Stanley, the dachshund, his first pet. He has hardly ever painted animals before, but these celebrate an intense relationship; the two are besotted with each other. On two easels are works in progress: uncharacteristically dark, brooding, semiabstract images of Wagner's doomed lovers, inspired by the opera project. In the past, heterosexual love has not commanded Hockney's interest. On the other hand, his most successful paintings have always taken their subjects from the faces and places of his daily life, and *Tristan und Isolde* had, by then, consumed months of thought and work.

The visitors this evening are independent producers who are thinking about televising the new *Tristan*—sets by Hockney, direction by Jonathan Miller, music conducted by Zubin Mehta—after it opens at the Los Angeles Music Center. "I'm not too keen," Hockney mutters about their proposal just before they arrive. You can see why when the spectacle unfolds. Recorded Wagner cascades through the darkened studio while Hockney sits at a miniature console and stages a thrilling show for them.

Even in small scale, the effects are breathtaking. He has designed sets that appear to surge far and high into space and has managed a unique marriage of lighting

Surrounded by recent work, an irrepressible Hockney takes time out in his Hollywood Hills studio.

Private collection, Los Angeles

Beverly Hills Housewife was painted in the mid-'60s, when artist had first acclimated to life in Hollywood.

with music. Hockney once defined theater design as "the making of pictures onstage." For Wagner, the spectator is introduced to visual poetry that is like a walk through the Louvre, and it's hard to imagine the magic transmitted effectively through the little screen at home. The visitors, three successful-looking middle-aged men, watch intently and occasionally ask shrewd technical questions.

"Bravo," one says quietly when the studio lights come back on.

"Great stuff," says another.

Hockney walks the producers out of the studio and does not return. The next day, his view of the TV idea is unchanged. He's still not too keen.

Certainly he doesn't need the attention that television would bring him. A few miles down the road, his old studio, now an office as well as storage space, houses two more employees, whose duties include protecting him against invitations to paint, to design, to exhibit, to lecture, to come to parties. Superstardom in today's art world approaches big business. He has been internationally celebrated for years, probably the best-known living British painter of our day. Time—time to work and time to think—is the successful artist's supreme luxury. That night of the *Tristan* light show, Hockney was only a season away from an event that was bound to inspire a tidal wave of interruptions.

On February 4, the Los Angeles County Museum of Art (LACMA) opens a Hockney retrospective, which will run through April 24. It is one of the largest shows LACMA has ever devoted to an artist. Funded by AT&T, the exhibition has major examples of everything to which he has applied his hand and eye and vivid intelligence: the familiar and magnetic California pool paintings of the 1960s; the theater work of the '70s; the sweeping photocollages and immense canvases of this decade; the Home Made Prints; the Chinese-scroll movie slyly entitled *A Day on the Grand Canal with the Emperor of China or Surface is Illusion But So is Depth.* (The show will travel to New York's Metropolitan Museum of Art—June 18 through August 14—and then to London's Tate Gallery, October 26 through January 3, 1989.)

LACMA's director, Earl A. Powell III, says that in conversation Hockney never refers to the exhibition as a retrospective, insisting on calling it a "journey" instead. In public, Hockney is given to behaving as if too much fuss can be made about occasions of this sort, and he calls it a "show" as in, "It's just another show as far as I'm concerned."

Nevertheless, Hockney made an innovative contri-

Helen Dudar concentrates on cultural subjects. She most recently wrote on the Smithsonian's new museums in the Quadrangle, September 1987.

One of Hockney's ambitious works of the period, its structure is architectural, the surface struck with light. Says Hockney, "I did a specific portrait and a specific house, a real place... from drawings and photographs."

bution to the exhibition's luxurious catalog, being published by Harry N. Abrams in conjunction with LACMA. At some point during his conferences with the museum people, he recalls saying, "Give me a few pages and I'll do something." Shortly before, he had begun "playing around" with the photocopy process. If "playing" seems frivolous, it helps to remember that Hockney's art is fueled by an intense, youthful curiosity and by a child's gift for obsessive inquiry. "I've still got a lot of the child in me," he said one day. "To be still thrilled by the world is like being a child."

Hockney's introductory—and thrilling—encounter with a color copier occurred in February 1986 during a visit to a Los Angeles friend who owned one. In an hour, Hockney explored and had begun to learn what a machine might do as camera and printer. He immediately went out and bought one. By March, he had acquired several medium-size copiers and leased a king-size model and was turning out prints that sell for about $2,000 a picture—a bargain of sorts when you consider that early Hockneys may fetch a quarter of a million dollars at auction. The Los Angeles Music Center is paying him $25,000 for the *Tristan* project, penny-candy money for a high-priced artist who would spend more than a year working on it and require the help of two assistants. Hockney, an opera addict, has a fine time with the notion that office-copier art has subsidized sets and lighting for a great Wagner work.

The copier process is not unlike conventional color printing. Each set of elements to be printed in a different hue—red, blue, green, brown, black and more—is drawn on a separate sheet; a print is positioned in

Overleaf: The last of Hockney's photocollages is *Pearblossom Hwy., 11-18th April 1986.* Highway runs through Mojave town northeast of Los Angeles.

Courtesy of the artist

PEARBLOSSOM HWY
CALIFORNIA
138
STOP
AHEAD

Courtesy of the artist

Self-portrait, July 1986, one of the artist's "Home Made Prints," was created on office copying machine.

the machine to receive the colors one at a time and thus produce the artist's final image (left). The result: an original work of art (as opposed to a photograph of the print, which would be a reproduction).

For his contribution to the catalog, Hockney created *Commercial Printing is an Artist's Medium*, a sly jab at the self-importance of the contemporary art world. He holds up one of the catalog prints and says, "For a page in a book, that's very strong, isn't it?" The images are immediate, bouncy, playful and cheerful, and the pages offer a minisurvey of Hockney in midcareer. There is the inevitable print of Stanley, whose round little body delivers a lesson in black-on-white curves bounding over a blue surface. There is an eerie forest in which everything seems to be in motion. There are echoes and appreciations of Picasso, whose art has always commanded Hockney's enthusiasm.

The working-class Yorkshire lad surviving in Hockney, not to mention "my anarchist heart," is amused that this bargain-basement process allows him to do his bit to subvert the economics of the art establishment. Hockney feels strongly that art has become too expensive and too respectable and that today's successful artists, including himself, are wildly overpaid. Even contemporary etchings and lithographs, once the beginner's affordable entry to collecting the work of important artists, are now often beyond the young art-lover's reach.

You can live without jewelry . . . but art?

In common with other artists of his time, Hockney also believes in the holy power of art, the power of art to heal, to teach, to better the world. Leaning on a cabinet and still clutching his brochure of Home Made Prints, Hockney almost somberly recalls an encounter with a man who insisted that art wasn't for everyone. "I said, 'Well, if that's the case you've reduced art to the level of jewelry. And jewelry is all very nice, but we could live without it. We can't live without art. We all need art. You might say most people get by with a very low level of art. Nevertheless, it's art of some kind. We have to have it.' "

Hockney was born in 1937 and brought up in the dark, industrial English city of Bradford, and the place as well as its speech—the musical lilt and dropped *h*'s of Yorkshire—are still very much with him. The family means, dependent on his father's job as an accountant's clerk, were modest; he remembers that a neighbor who could support two pet cats was thought to be rather well off. There were five Hockney children and a pair of loving parents. The city had no art museum, but had concert and theater groups and, occasionally, even traveling opera companies stopped there and could be seen for sixpence from the highest point in

Hockney designed this electrifying set for Act II of new *Tristan und Isolde*, which opened in Los Angeles. Preeminent in field, he has created sets for works by Mozart, Satie, Stravinsky, Poulenc and Ravel.

the balcony. Once a week, the elder Hockney took his two youngest sons out for a stand-up meal at a fish-and-chips stand, followed by the Saturday-night show, whatever it was, at the Bradford Alhambra.

By his 11th year, Hockney knew he wanted to be an artist, although he had no notion of the pains or pleasures, the demands or rewards of the life. He went to the Bradford School of Art and, at 22, went down to London to the Royal College of Art. Even before he had graduated, word was out that Hockney was a young man to be watched. Fellow students bought his etchings and drawings, and an important London gallery signed him up by the time he had his diploma. Hockney's first year at the Royal College had been desperately poor—he lived in a shed in Earls Court and washed up in school sinks—but he insists that by his second and third years he was on his way to being rated as a rich student.

He has come a distance since then, all the way to the Hollywood Hills, to a bright pink house with bright blue trim and a swimming pool with squiggly lines. The night after the *Tristan* demonstration, Hockney is in his living room and has settled into a delicate-looking Victorian settee, a gift from the film director Billy Wilder, who is both a friend and a portrait subject. At the start of the evening, Hockney stretched out on the piece and, in the pose of analysand, mockingly asked, "Whaddya want to know?"

Obligingly, he went on remembering his lucrative student years. "I bought cigarettes in packets of 20, not 10, things like that. The moment you can live on your work as an artist, you're a rich person. Because after all, you're interpreting life itself. A bank president on his deathbed might say I'd have rather been a poet. It'll never be the other way around. In that sense the artist is a rich person. The moment I had money just to pay myself, even though it wasn't a great amount, I thought 'This is marvelous. I'm doing what I want to do now.' " Stanley, on the floor beside Hockney, interrupted with a little woof to attract his attention. Hockney turned a benign blue eye on his dog and cooed, "Look at little Stanley. Sweet little face."

On graduating, Hockney received a gold medal and attended the ceremonies in a gold jacket that he had bought. By that time he had visited America and, heeding a television commercial promise that "blondes have more fun," had chemically altered his dark hair, as he still does, to an improbable shade of yellow. He has always indulged a rather mild, innately British streak of eccentricity. There are frequently times when his socks are ostentatiously mismated; others when his spectacles are funny. Around the studio, he usually looks as if he had stumbled into a neighbor's clothes. But the shirttail hanging out of the baggy, paint-stained pants is recognizably Hockney: it is almost always striped, usually white and red, green, or blue.

Drawn by the sun, the light and the generous sexuality of Southern California, Hockney settled in Los Angeles soon after leaving art school. Some years later, he moved on to London and then Paris. In 1978, he

Courtesy of the artist

Friend Celia Birtwell, drawn here in pencil, has sat for portraits in various styles and settings.

Museum of Modern Art

Complex and playful work was derived from Hogarth frontispiece for a perspective book by John Kerby.

came back to the West Coast and has been there ever since. Obviously, wherever he lives provides material for his art, but there have been periods when he has hardly touched a brush to canvas. Friendly critics have viewed these times as Hockney's painting blocks. Hockney, who has faint tolerance for Freudian labels, disagrees. Basically, he says, he has left off painting for long periods to concentrate on designing for theater or on photography. He sees these activities as productive research, forms of inquiry that have replenished the easel works.

"For instance, I felt I had to deal with photography, *had to*. It took me three years to do that and I painted very little. I knew I was discovering things and I knew it would change everything I did."

Over the years, Hockney has filled 120 albums with snapshots of friends and travels, but he has always been distrustful of photography as a way of seeing. "Photography is all right," he once said, "if you don't mind looking at the world from the point of view of a paralyzed Cyclops—for a split second." The camera-works he is talking about are his photocollages, big, complicated mosaics created by snapping multiple pictures of a person, place or object. The result is a fractured image—not unlike the fractured images of Cubism—that demands more than a frozen-Cyclops' glance; it pulls the eye across the work horizontally and vertically. Essentially, he has made *time* an element of the art. Hockney's friend, Henry Geldzahler, the art historian and critic, calls it "drawing with a camera"; while the technique is not original, he points out, no photographer comes to it with Hockney's mastery of line. He is, above all, a brilliant draftsman.

Painting the space of photography

The last and largest Hockney photocollage, more than 6 feet by 9 feet, is a piece entitled *Pearblossom Hwy., 11-18th April 1986* (pp. 66-67). He claims to be finished with photography. "All the intensity is gone. I don't have to do it anymore. Actually, I couldn't have done the spaces in *Tristan* without the photography. And now I know how to put it in painting."

A major show of the photocollages began traveling around the country in 1986 to much acclaim. Indeed, it became fashionable to pronounce the camera studies superior to the painting. There is also a camp that says he has done little memorable art since the pools and fine double portraits of the '60s and early '70s, and yet another that is uncomfortable with the overt charm of many of his pieces, as if it were somehow sinister for art to give easy pleasure. LACMA's Stephanie Barron, an obvious partisan, says few living artists are as well known and as little studied. He has not had a retrospective since a 1974 show at the Musée des Arts

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Décoratifs in Paris; she expects to surprise at least some of the art world with the range of his work and the obvious willingness to take risks.

Hockney's painting has altered dramatically in this decade, partly as a result of an enthrallment with the late work of Picasso, even more directly out of a continuing restless discontent with the boundaries of canvas. On the simplest level, conventional composition could be said to position the spectator outside the work. But Hockney's photocollages and recent big paintings insist on pulling the viewer in. By compelling the eye to track the artist's travels along the surface of the piece, they again add time to the dimensions of the work.

He is given to saying that art is not simply a record of an object or of an idea but a process of discovery; thus the artist's life is forever a quest for a vision, for a new way of seeing. One night, Hockney pushed a cassette into his VCR to play a rough cut of the Chinese-scroll film. When Philip Haas, grant in hand, came to him to propose a 10-minute film, it was Hockney who suggested using the scroll for what would become a 50-minute piece. The scroll, which he found a few years ago in New York at the Metropolitan Museum of Art, is a great favorite, a 17th-century work, 72 feet long, crowded with 3,000 figures, nearly all of them in motion.

The cassette began unreeling and Hockney appeared on a 27-inch TV screen. Behind him was a Canaletto painting of a Venetian scene that would serve as contrast. Gently unfolding the silk scroll, he began a fluent, ad-lib lecture (he turns out to be a skilled teacher, not to mention a preacher). The figures in the Canaletto, he observed, are frozen in time. The people of the scroll, on the other hand, are vibrantly alive and on the move. They are to be seen buying and selling rice, catching fish, bargaining their wares, gathering on the shore to gossip or quarrel and watch the emperor sail down the canal. Significantly, the perspective shifts and alters constantly and, in one space, may carry the eye in several directions.

The Canaletto, he went on, is a kind of window. It

Tate Gallery, London

Mr. and Mrs. Clark and Percy is portrait of Celia Birtwell, husband Ossie and cat. The work is a tour de force of period (1969-72) and Hockney, who worked and reworked it, recalls it "was quite a struggle."

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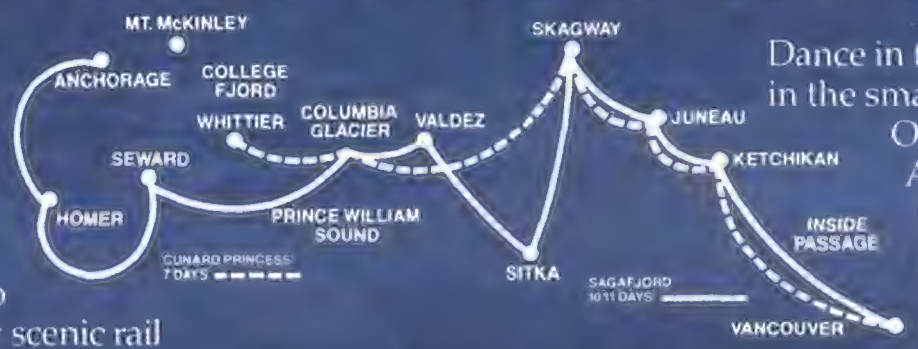

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is on the wall, the appropriate place for a window. But the scroll on the table can be moved and can take him anywhere he wants to go in the picture, backward and forward, up and down streets. And he—not a picture frame—controls the edges.

Hockney loves that scroll and has apparently coveted it since first encountering it five years ago. He does not normally have the collector's itch. A man who is satisfied with postcards of favorite paintings, he owns only one important piece by another artist, a small, late Picasso he acquired in exchange for two of his own large canvases. The scroll is on permanent loan to the Met by its Canadian owner. "Guess what it cost," Hockney demanded over dinner one night.

"It was probably cheap," a visitor guessed.

"You're right," he nodded, adding mournfully, "I could have bought it." The price was $250,000.

Hockney's work with the camera and his fascination with Chinese scroll art have inspired several enormous horizontal works, one of the largest a 20-foot-long double canvas called *A Visit with Christopher and Don, Santa Monica Canyon, 1984* (below). It draws us in, asking us to come down to the beach and the ocean and finally to the house of the visit; to enter it and roam its rooms. At the right, we come upon the writer, the late Christopher Isherwood, typing; far at the other end we find his companion, Don Bachardy, at work at his easel. The hues, however, are a keen contrast to the faint tints of Chinese scroll art; Van Gogh and Matisse colors detonate throughout the picture.

Across the years, Hockney's work has been subject to equal parts of high praise and heavy dispraise. When the new Museum of Contemporary Art in Los Angeles launched its spaces with a yearlong survey of 77 important artists, his work was conspicuously absent. Hockney insists he takes none of this seriously. "It's not that I'm that secure. I'm as insecure as other people. I have a certain confidence—I think I follow my intuitions and I think they lead me on to discoveries. It's always about discoveries. I think the art world is quite corrupt. I don't have a high opinion of it and I don't have a high opinion of a lot of the writers."

He is such an enthusiastic talker and, at times, so open and easy that one is inclined to forget there is often a veil between him and much of the world. An encounter with Hockney is a little like those eerily beautiful double portraits of his earlier years: lovers, friends, spouses are separated by a few feet, and the

A Visit with Christopher and Don, Santa Monica Canyon, 1984 measures 6 by 20 feet and records a trip

André Emmerich Gallery, New York

gap is unbridgeable. Henry Geldzahler called the artist's public side "that smiling British boy," the cheerful persona girdled with inhibitions against allowing anger, grief or fear to show.

Critics have suggested that, in some ways, his great fame has been a burden. When the subject is raised, Hockney responds with silence and then says slowly that "celebrity is a burden," not fame. There are lawyers and accountants and demands on his time that he finds hard to refuse. "I've learned to get tougher and say no. I'm too amiable, I think. Sometimes I think, well, maybe you'd be a better artist if you were less amiable. In middle and old age I've become a bit of a Mr. Grouser."

When they are together, Geldzahler, Hockney's closest American friend since they met in Andy Warhol's studio in 1963, says the artist complains all the time about outside pressures and demands. When Geldzahler points out he is grouching about the obverse of success, he is told, "But you don't know—it's so sad." What could be so sad? "That he's not a little kid anymore," Geldzahler guesses. "That he's out there in the world, I think." In his contribution to the LACMA catalog, Geldzahler writes of the "loss of innocence" that the artist and his art have sustained as he has confronted the fact of the impermanence of life: the death of Picasso in 1973, that of his father in 1978, the fearful toll AIDS has taken of a legion of friends—these dark events haunt him, according to Geldzahler.

Certainly intimations of mortality have crept up in recent years: like his father, Hockney has suffered hearing loss, now so severe that he wears amplifiers in both ears, a punishment for a man as addicted to opera as he is. In his bedroom late at night, he removes the little earpieces and turns up the compact disk player very loud. To prepare and fuel himself for the *Tristan* designs, he estimates he played through six different recorded versions of the opera at least a hundred times. The intellectual in Hockney can examine the hearing problem with cool objectivity and he is mildly intrigued by the question of its impact on his art. Since hearing has obvious spatial elements, Hockney has wondered whether losing so much of it may have, as compensation, resulted in an increased perception of and preoccupation with space. As yet, he has found no answer. But then, if, as he says, the ultimate aim of art is discovery, all he needs is the right question.

to and through the house of Christopher Isherwood (at right) and his companion Don Bachardy (left).

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By Bil Gilbert

This cat is shy and set in its ways, but a master of its profession

While other predators are more pugnacious and adaptable, when it comes to catching snowshoe hares, a Canadian lynx has no peer

In the days when they were a free people, confident of their views about the nature of the world, oral historians of the Shawnee told a story that runs as follows:

"A long time ago a wildcat pursued a rabbit and was about to catch him, when the rabbit ran into a hollow tree. The wildcat took a position in front of the entrance and told the rabbit that he would remain there until the rabbit, from hunger, would be induced to come out; that he need not think of escape. After a time the rabbit said he would come out and let the wildcat make a meal of him on one condition, and that was that the wildcat should make a fire in front of the tree, saying that as soon as a bed of coals sufficient to roast him had been prepared he would come out and be roasted; he did not want to be eaten raw.

"The cat built the fire as directed, and when the sticks were burned into coals, he settled himself on his haunches and notified the rabbit that all was ready. Whereat the rabbit gave a spring, striking all his feet into the coals and knocking them into the face and even over the breast of the cat, and then escaping."

This particular cat went hungry, but more important, said the storytellers, the marks burned into his coat proved to be genetically indelible. Since then, all wildcats have been spotted, memorializing the manner in which their forebear was duped.

The Shawnee were great jokers. Both men and women affiliated themselves with clans named after particular animals—the turtle clan, the wildcat clan, the rabbit clan—and they often concocted silly stories to kid each other. In the present instance, it was a member of the rabbit clan, of course, who would tell the tale at the expense of someone in the wildcat clan.

But the Shawnee were also—because their survival depended on it—fine natural historians. They were not much for collecting statistical data about weights, litter sizes and ranges. They were apparently more interested in qualitative behavioral matters and made many observations that, though sometimes recorded in an entertaining style, still seem insightful. Thus, although their story about the clever rabbit did not mention which of the native spotted cats was involved, it was probably a lynx.

Informally, when wanting to get to the heart of the matter, contemporary biologists will say that the lynx is a comparatively slow-witted animal whose activities are largely dictated by those of rabbits—specifically snowshoe hares. When it comes to respectable professional discourse, less light and anthropomorphic language is, of course, employed. For example, Ted Bailey and Bob Stephenson are biologists currently conducting lynx studies for, respectively, the federal and state governments in Alaska, where nearly all of the animals of this species in this country now reside. Both men recently had occasion to remark that the North American lynx is a classic example of a mammalian predator being largely dependent on a single prey species; that when snowshoe hares are plentiful they make up 80 percent or more of the diet of a lynx; that the lynx is singularly unadaptable, i.e., has difficulty supporting itself when hares are scarce. All of which, allowing for differences in terminology and style, is similar to the Shawnee view.

Students of natural history do not put much stock in the magical creative theories of the Shawnee and the other original settlers of these parts. However, in our own way we remain curious about how things came to be as they are. In regard to the lynx, evolu-

Only partially concealed in brush, a lynx warily eyes an intruder. Its curiosity can get the cat in trouble.

Photographs by Alan Carey

C. C. Lockwood

A stubby-tailed cat seizes a bird. Lynx feed mainly on snowshoe hares but can catch other prey in a pinch.

Bounding after a snowshoe hare, lynx attempts to make the kill before its more buoyant prey gets away.

tionary speculation presently goes something like this:

Many years ago, four million or so, there came to be in Africa a catlike creature a bit smaller than the present cougar. It is now known only from found bony fragments, but has been named *Lynx (Felis) issiodorensis*. The species moved northward and, perhaps in response to changes in climate and competition from larger carnivores, became smaller, so as to prey on smaller rodents and lesser hooved stock. In northern Europe and Asia, this animal turned into what is now thought of as a "true" lynx, that is, a long-legged, warmly furred, pointy-eared (the reason for the tufts is unknown, but they are thought to have an antenna-like function) cat of 50 pounds or less with outsize feet that enable it to support itself on the surface of deep snow. Concurrently, *Lynx issiodorensis* may have moved eastward and eventually crossed a land bridge connecting Siberia to North America. Here they pioneered southward and about 2.5 million years ago became approximately what we now know as the bobcat, very similar in conformation and size to the lynx but lacking the snowshoe feet. Much more recently, around 200,000 years ago, the land bridge formed again and the true lynx moved across it from Asia to North America and evolved into the Canadian lynx (*Lynx canadensis*). Again its size decreased, possibly to make it better equipped to deal with the snowshoe hare, which was significantly smaller than its previous chief prey, the roe deer.

Except for some very open prairies in the Midwest, the bobcat has traditionally ranged throughout most of North America from central Canada to southern Mexico. Preying on a wide variety of birds and small mammals, it thrives in coastal, woodland, swamp, mountainous and desert regions. Also, it is one of the few largish carnivores (a peer of the fox and coyote) that have not been greatly discommoded by the massive environmental changes that have occurred since the European settlement of the continent. Though seldom seen because of their secretive and nocturnal habits and somewhat reduced in total numbers today, bobcats continue to occupy most of the former range of the species, hanging on in odd brushy corners of even the most populated parts of the country.

In contrast, the lynx has apparently always been restricted to forested places where there is an abundance of snow and snowshoe hares. In highland areas, patches of such suitable habitat extend to Virginia in the East and Colorado in the West. However, for more than a century few lynx have been found in the southern portions of the range, having been exterminated rather rapidly by Man-caused environmental changes, by trapping or because they were bountied as varmints. In New England, the upper Great Lakes and the Northwest, along the extreme northern borders of the lower 48, there are now small populations, but the species is rare except in Canada, Alaska and some regions of northwestern Montana.

Bobcats and lynx never—or at least not for very long—inhabit the same territories. A fairly recent happen-

Natural history writer Bil Gilbert celebrated lizards in the August 1987 issue. He is now working on a book about Tecumseh, the Shawnee chief.

The reason for the prominent tufts on the predator's ears is unknown, but there is no question what its big feet are for. They provide good launching pads for attacks and help cat avoid bogging down in the snow.

ing suggests that, on the fringes of their respective ranges, this segregation is the result of direct, confrontational competition. Historically, lynx and snowshoe hares were found throughout Canada's Cape Breton Island but there were no bobcats. In 1955 a causeway was built, connecting the island to the Nova Scotia mainland. Bobcats crossed the bridge and, being the more aggressive animal, established themselves as a breeding species on Cape Breton. As they did so, according to Gerald Parker of the Canadian Wildlife Service, the more submissive lynx began to retreat. Now lynx are abundant only in the highland areas of Cape Breton Highlands National Park, while bobcats occupy most of the lower-lying portions of the island. The deeper snow of the highlands proved to be a barrier to the bobcat and so long as the lynx had no close competitors, they did well there.

Bob Stephenson, the Alaska state biologist, has learned how lynx hunt from their tracks in the snow. He says that typically, after first hearing or seeing a hare (lynx have indifferent noses), an animal will either freeze and wait, or commence a slow stalk, gliding across the snow on saucer-size feet that are so heavily furred as to be, in effect, webbed. Beyond allowing a lynx to move more easily in soft snow than can a small-footed animal, the outsize paws give purchase for an initial rush that, Stephenson says, is impressive. "I've measured six- to ten-foot bounds. If they miss on the first try they'll bound along after the hare, throwing up showers of snow. From what I've seen, a lynx either makes a kill or gives up after the first 50 yards or so. The speed of the two animals seems about equal but, being so much smaller, the hare is more buoyant. Surprise and the first fast rush are the edge lynx have. Often, however, that advantage is not enough. Lynx are successful less than half the time."

On bare ground, lynx are also ambush-and-pounce hunters and by no means ineffective ones, since they are not designed to fast for two or three months out of a year. It is in the deep-snow country, however, that these cats have no peers as predators.

The lynx is endowed with a heavy coat that enables it to function well in extreme cold. However, it is rarely found in the high Arctic above the tree line, even though these regions support what would seem to be a very suitable prey species, the Arctic hare. Again, foot size and shape seem to be the critical factors. Unlike the snowshoe hare, the more-northerly hare is narrow-footed, having no reason to be otherwise, since the barren grounds are relatively arid and the snowpack on them is hard but not deep. They would present somewhat the same predatory problems to a splay-pawed lynx as a jackrabbit might present in the temperate plains. In consequence, lynx, as rabbit catchers, give way in the North to Arctic foxes and tundra wolves, as they do in the South to bobcats and other swifter-on-solid-surface hunters.

What might best be called temperament may also have something to do with the relationship between the lynx and its closest competitors, especially the bobcat. "Anthropomorphically speaking," says Bob Stephenson, "the bobcat seems to be a much tougher, more pugnacious animal. In a trap or when cornered a bobcat will fight back. In a similar situation a lynx

After fording a shallow creek, kittens sit in the sun and take turns playfully licking each other dry.

tends to be fairly docile and passive." Stephenson knows of no records of a bobcat preying on a lynx but thinks it is quite likely that, should individuals encounter each other (as they apparently did on Cape Breton), the bobcat would drive the lynx from its hunting and breeding territory.

By and large, the lynx leads a solitary life. Adults tend to establish themselves in a given area and avoid contact with others of their kind except during the brief courting and mating period that occurs in the latter part of March. Kittens, two to five in a litter, are born in May or June in well-hidden dens under brush or windfalls or in hollow logs. They are weaned at about 12 weeks and thereafter commence hunting with the mother, usually remaining with her until the next breeding season.

Foraging, a lynx family sometimes fans out, the kittens functioning somewhat as beaters as they jump hares, chasing them, more by accident than design, toward one another. In the process they begin to acquire hunting skills, but Bob Stephenson thinks that well into winter the mother continues to do most of the actual killing for the family. In a good year, each lynx could consume 250 or so hares. However, one of the certainties in the lives of these animals (at least those who lead full lives of five to ten years) is that they will experience bad times.

As is the case with many Northern creatures, snowshoe hare populations fluctuate dramatically but rhythmically. At times there may be nearly 1,000 hares for every 250 acres, but five years later less than five in the same area. This pattern of decline and recovery predictably repeats itself every ten years or so. The trigger mechanisms are not well understood, but a number of things may contribute to the phenomenon, including abundances and shortages of food, social stress (which increases as populations do), meteorological, electromagnetic and disease cycles and the workings of biological clocks.

How lynx populations fluctuate

Predation is part of all this but, in the main, hunting animals react to the numbers of their prey rather than controlling them. The connection between lynx and hares is particularly obvious and close. Lynx populations experience peaks and valleys 6 to 18 months after those of the hare, but the rate at which the two species decline and recover is very similar. When hares become scarce in a given area (the peaks and lows occur at different times in different places), lynx respond in several ways.

They may migrate as much as 400 miles to seek new areas where hares are still abundant. Notwithstanding the fact that lynx are loners (except when mothers are

Mother lynx is nuzzled by a kitten as she drinks at the edge of a stream. Lynx are loners, but mothers stay with their young through first winter. Litters are dropped in the late spring—usually two to five kittens.

accompanied by their kittens), there are reliable reports that at times several individuals may choose to travel together.

Lynx will also attempt to get other food when hares decline. They are known to prey occasionally on mice, voles, squirrels, birds, foxes and caribou calves. However, because of the physical limitations noted, the lack of acquired experience and the competition from more-aggressive predators, they seem to have indifferent success at switching to alternative food sources. Researchers working in Alberta found that when hares make up less than 65 percent of the lynx diet, the animals are faced with starvation. Both Stephenson and Bailey believe that only the fittest, most experienced lynx survive during low-hare years; most kittens die of malnutrition.

Competition between lynx probably increases when hare populations crash. Stephenson gives an account (reconstructed from tracks in the snow) of a lynx that after considerable effort managed to pull down a caribou calf. However, while at the carcass the cat was attacked and killed by another lynx. Stephenson believes that cannibalism, particularly by males on kittens, may not be an uncommon occurrence.

Robin O'Connor of the Alaska Department of Fish and Game undertook the heroic task of examining the ovaries and uteruses of, and analyzing data collected from, more than 3,000 lynx turned in by trappers. From the evidence of placental scars, she found that while yearling females regularly conceived in years when hare populations were high, they all but ceased doing so when hares became scarce. Also, the reproductive rate of mature females was reduced by more than half in low-hare years.

As a description of these happenings, the expression "boom and bust" is graphic but somewhat misleading. It suggests an aberrant state of crisis. In fact, from an overall standpoint, the cycle promotes the long-term fitness of the lynx as a species.

Wolves, coyotes, wolverines and large birds of prey may occasionally kill lynx (particularly kittens) but generally only humans—specifically, trappers—are substantial predators on the species. Lynx are taken in a variety of steel, snare and cubby traps. Often baits are not used. Rather, strips of cloth, bits of aluminum or even Christmas tree ornaments are tied to a branch above the set, where they can twist and bob in the breeze. Lynx are taken as they come by to investigate such novelty items. This habit has contributed to their reputation for stupidity, but this view is largely an expression of bias. Not being scent-hunters, lynx are not made suspicious by human odors. Also, as are other cats, they are very curious because their profession, so to speak, requires them to be.

Cat licks snow stuck in web of oversize paw. A lynx foot supports twice the weight of smaller bobcat paw.

Ever since the European-style fur trade began in North America, lynx skins have been an item in it. Throughout most of this century, however, the long, luxuriant fur has been used mostly for trim and ornamental purposes since it is considered "soft"—that is, it wears quickly, leaving bare or thin spots.

Professional trappers as a rule have only set specifically for lynx when they were very numerous, easy and cheap to get. Since most of the animals were therefore taken during the peak of their population cycle, they were surplus in the sense that a few years later they would die for natural reasons, the decline of hares. In the past 15 years, however, the longstanding, self-regulating balance between lynx trappers and lynx has been disrupted, particularly in Alaska, as a result of changes in conservation laws and fashions, and the plummeting price of oil.

The skins of exotic spotted cats—leopards, jaguars, ocelots and such—have long been prized by furriers. Their popularity led, first, to many of the animals becoming rare and, second, to national laws and an international treaty aimed at conserving the felines by stopping the traffic in their hides. These measures placed new pressure on two of our native spotted cats, whose status must be monitored but who are not directly protected by the international agreement.

In part because of the ban on the tropical-cat trade, and partly because of trends in fashion, lynx fur has become very stylish and expensive. A coat made from the highest-quality matched pelts may sell for $50,000; more ordinary ones cost $15,000 to $25,000. An outstanding lynx pelt now commands a top price of $450 to $500, which is more than enough to make it worth the while of professional trappers to concentrate on these animals. Furthermore, many new and part-time trappers are setting for the lynx these days because of the high value of their pelts and the current sluggishness of Alaska's oil-based economy.

Increased trapping, fewer lynx

The marked increase in trapping raises a number of questions about the status of the lynx throughout Alaska and particularly in the Kenai Peninsula, the site of Ted Bailey's study. The Kenai is a 9,050-square-mile archipelago jutting into the Gulf of Alaska, south of Anchorage. There are now some 40,000 people living permanently on the peninsula, which in terms of human population has recently been one of the fastest-growing regions of Alaska, and which has become a major attraction for out-of-state tourists. The scenery is grand, the salmon fishing is excellent and the Kenai National Wildlife Refuge (which occupies about a third of the area) is renowned for its game. For the same reasons that prevail elsewhere in the state, many residents started trapping lynx on the peninsula, and the result has not been good.

Lynx and hare numbers peaked on the Kenai in 1973-74. During that season, 81 permits were issued to trappers in the wildlife refuge, where Bailey works, and 245 lynx were taken. Thereafter, as was natural for them, hare and lynx populations crashed but the number of trappers continued to increase. The next peak in the predictable cycle should have occurred in 1983-84. It did, but only for the hares. Bailey and his associates found that in some portions of the study area there may have been up to 2,000 hares per square mile, one of the highest densities ever reported anywhere for this species. Nevertheless, only 38 lynx were trapped in the 1983-84 season despite the fact that 114 trapping permits were issued, or 41 percent more than during the last peak.

Bailey has also compared his data with those from lynx-hare surveys made elsewhere in the North. Extrapolating from them he calculates that there may have been enough hares in the Kenai area during 1983-84 to support up to 340 lynx. However, he and his associates estimate that in fact there may have been fewer than 30 resident lynx.

Based on this and on data from radio-collared lynx, Bailey has developed an explanatory hypothesis. Dur-

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"Nothing but time passing,
the blue and white
line of the sea-sand,
the ocean."

Pablo Neruda

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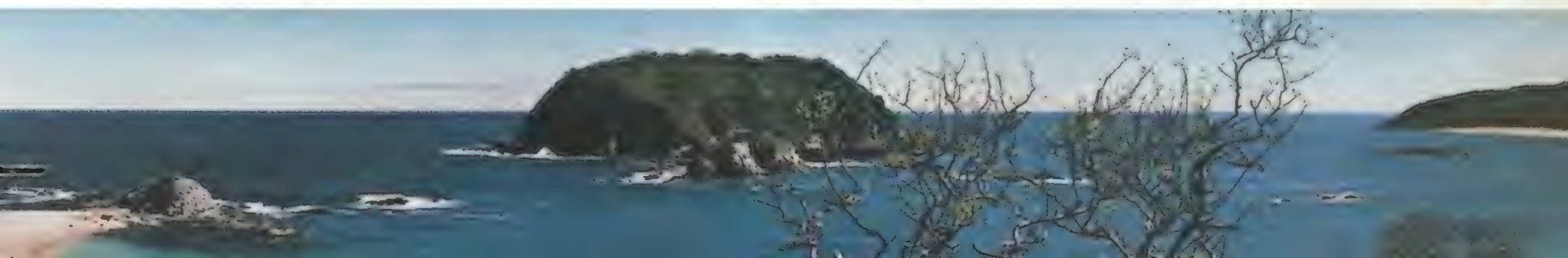

ing low points in the typical lynx-hare cycle, he reasons, a minimum number of animals must survive if the population is to recover when hares are abundant. However, Bailey believes that because of high mortality rates from trapping, the Kenai lynx population, during the last low point in its cycle, was reduced below the usual minimum level. Though his research is still in progress, he thinks enough has been done to demonstrate that lynx numbers have not increased as they naturally should and could have, and that there is a good possibility they will not unless new protective measures are taken.

The Kenai situation is also complicated by the fact that the peninsula is virtually an island. Lynx cannot readily leave it to find new territories and, in Bailey's opinion, the local population is not often augmented by animals emigrating from the mainland. If the species should be eliminated on the Kenai, therefore, the chances seem poor that the lynx would naturally reestablish itself.

Two factors, which might be called biopolitical, generally influence wildlife management throughout this country. Management of resident wildlife—that which does not migrate across state lines—is regulated by state laws even on federal refuge lands. Legally, federal wildlife officials do have the ultimate authority to determine what happens to such creatures, but as a matter of political reality they usually make every effort to let state officials call even the toughest shots. Second, state wildlife officials tend, as a rule of thumb, to be more responsive to local hunters and trappers than are federal officials. In the case of the lynx, state game managers on the Kenai have contended that there was not enough population information to support some of Bailey's gloomier projections. But they (and a good many professional trappers, as well) have accepted the proposition that in this particular location the species may be in some, if not terminal, trouble. In 1984, a portion of the refuge was temporarily closed to lynx trapping to allow recovery of the population. Then, in 1987, following a decline in snowshoe hares, the entire Kenai Peninsula and other regions throughout south central Alaska were temporarily closed to lynx trapping for three to five years. Lynx seasons have also been shortened throughout other regions of the state.

Neither state nor federal biologists now think it will be necessary to ban lynx trapping permanently even on the Kenai, but both agree that new management approaches were needed. The present hope is that, shortly, enough will be known about the population dynamics of the species so that trapping regulations can be more finely tuned, perhaps even annually, in accordance with natural cycles.

It has been said that what goes around comes around. Another observation by the original natural historians of these parts—in this case, the Koyuko of Alaska—still seems astute and applicable to current lynx events. The Koyuko were of the opinion that the lynx was an idiosyncratic animal endowed with *biyeega hoolaanh,* a powerful spirit that made it alien to and disdainful of men and other animals. The Koyuko once said: "In the distant time, the bear and the lynx were talking. The bear said that when humans began hunting him they would have to treat him right. If he was mistreated by someone, that person would get no bears until he had gray hairs on his head. But the lynx said that the people who mistreated him would never get a lynx again in their lives."

C. C. Lockwood

Captive lynx and bobcat (lying on back) tussle in snow. In the wild, such encounters would be unlikely.

Emerging like a ghost from the silent woods, a lynx on the prowl embodies the wild spirit of the Far North.

It lowers the s

Can a car quiet the wind? In a sense, that is precisely what the new Honda Accord LXi is designed to do.

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ound of speed.

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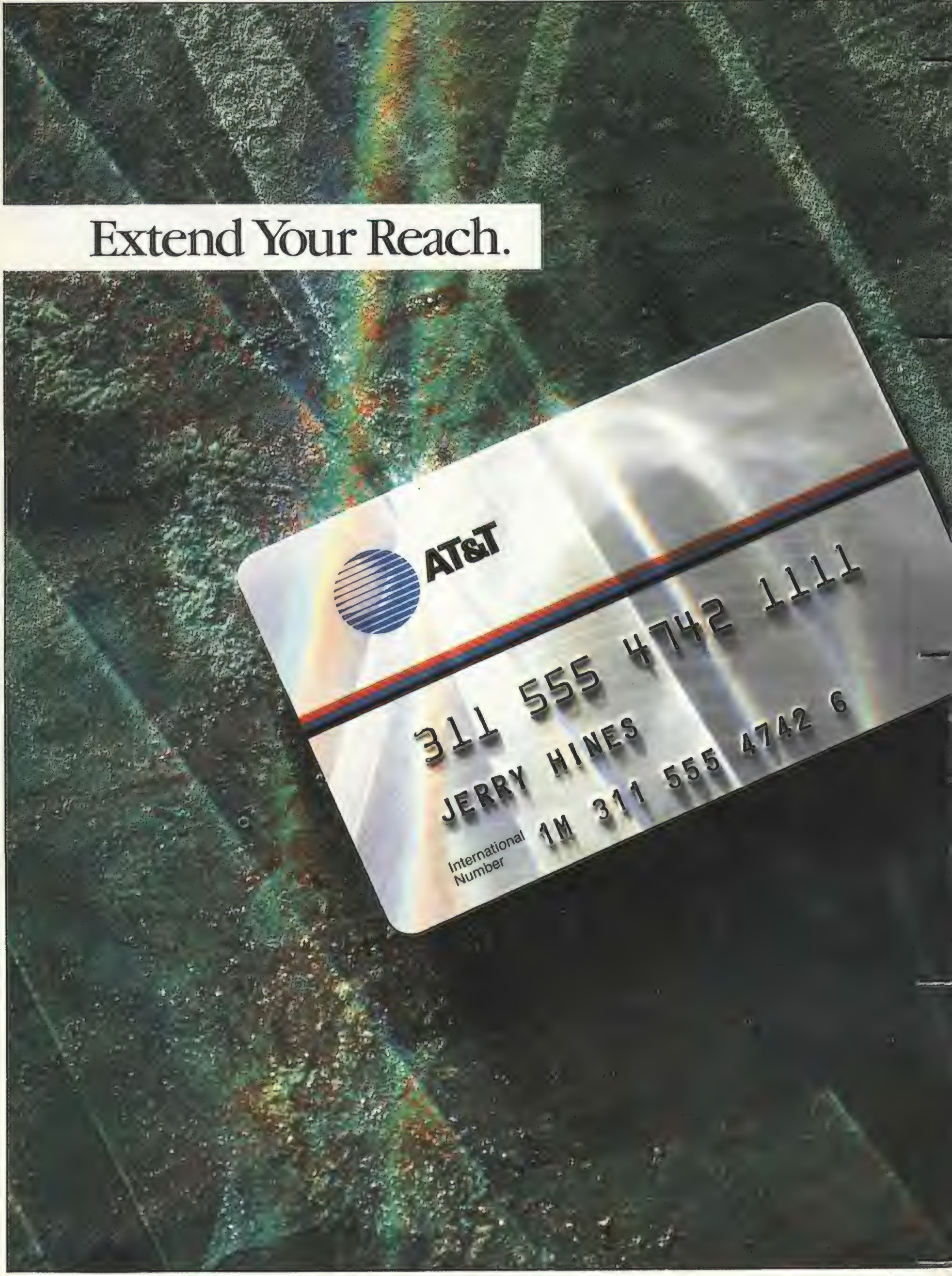

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The right choice.

By Barnaby Conrad

What happened to Mister Christian of H.M.S. *Bounty*?

In which a distant relative of the famous mutineer travels to Pitcairn Island and tries to unravel the mystery of Fletcher's fate

Terry Young, descended from a mutineer—like almost all Pitcairners—puts final touches on *Bounty* model.

Framed by breadfruit plants and fellow mutineers, Fletcher Christian looks on as Bligh is set adrift.

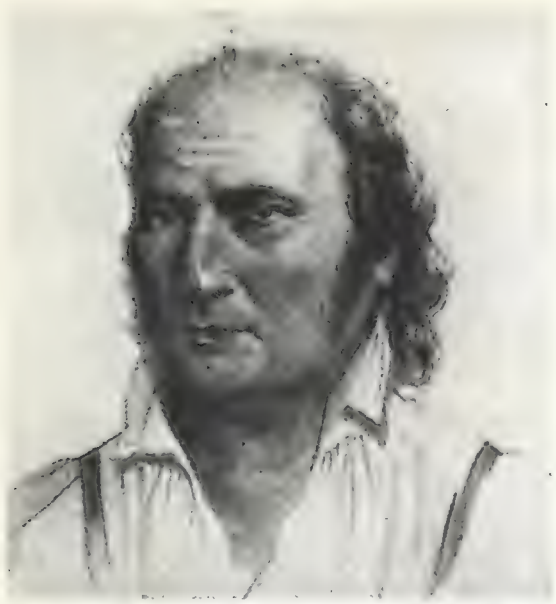
Everyone knows the story of Captain Bligh and his mutiny, the most famous of all mutinies. After all, there have been some 2,500 works—articles, books and movies—about the *Bounty* saga since it occurred almost 200 years ago on April 28, 1789.

But what happened to young Fletcher Christian, the leader of the uprising against the despotic captain? In the four movie versions, Christian (played in succession by Errol Flynn, Clark Gable, Marlon Brando and Mel Gibson) takes over the *Bounty* from the villainous captain, setting Bligh adrift in a longboat with those seamen loyal to him. After picking up his gorgeous lady love from Tahiti, he sails off to live happily ever after in the remote South Seas paradise of Pitcairn Island.

But was it a paradise? And did Christian live out his life on the island? Or, as some *Bounty* buffs have maintained, did he grow bored with the tiny island, his woman and his eight fellow mutineers and return to England, where he met Samuel Taylor Coleridge and inspired the classic *Rime of the Ancient Mariner*?

My interest in the *Bounty* saga has been heightened by a distant ancestral connection with Fletcher Christian through his first cousin. So I decided to learn what I could about the mutiny and its aftermath, and then to travel to Pitcairn to see for myself how the islanders—nearly all of them descended from the mutineers—view this legacy.

The takeover of the ship, Bligh's epic journey of 3,618 miles to Timor in a 23-foot boat and the eventual



John Adams, who lived in shack at right, gave contradictory versions of mutiny leader's fate.

trial of some of the accused mutineers in London have been extensively documented. But the events on Pitcairn Island are murky and the ultimate fate of Fletcher Christian has been a matter of conjecture and controversy.

After setting Bligh adrift with 18 members of the *Bounty* crew, Christian took the remaining 24 men and tried making a colony—the first in the South Pacific—on the island of Tubuai, 350 miles south of Tahiti. But after a few months of battling hostile natives and worrying about being discovered by English ships en route to Tahiti, Christian decided to seek a more remote island. Most of the men, having by now formed liaisons with Tahitian women, asked to be dropped off on Tahiti. Christian obliged, and then the *Bounty*, with 9 mutineers, 1 baby, 12 Tahitian women including Christian's mate, and 6 Polynesian men set sail for Pitcairn, about 1,200 miles to the east. It was a dot of land no white man had ever set foot on—Christian had merely seen it described in a book by Capt. Philip Carteret in the little library in Bligh's cabin. But it was the safest haven one could imagine, if only Christian could find it in the vast Pacific.

Despite Christian's fame, we know very little about the man. By contrast, we know a great deal about his nemesis, the sharp-tongued William Bligh. His tumultuous career included service as a young officer with Captain Cook; then as a naval hero in sea battles with Nelson's fleet; then as a controversial governor of Australia (with more than one mutiny to his discredit); and finally as a respected rear admiral.

We do not have a portrait of Christian, but we are told by Bligh that he was 5 feet 10 inches tall, dark-haired, muscular, bowlegged, with sweaty palms that soiled papers if he touched them. He also had tattoos on his hips and buttocks, acquired prior to the mutiny, when he and others of the *Bounty*'s crew went native during their six-month layover in Tahiti. He was considered a good subordinate under other commands and Bligh specifically asked for him to be on this voyage after having sailed with him before.

Born in 1764, Fletcher Christian was only 24 at the time of the mutiny. His family had been wealthy, but his father had died and his mother had gone bankrupt while Christian was in his teens, forcing him to go to sea. Fletcher's first cousin, Thomas Law, made a fortune in the East India Company (SMITHSONIAN, January 1988), became a friend of George Washington in America and married his step-granddaughter, Eliza Parke Custis, which is how I come to be remotely related to Fletcher Christian. I have long known that I am descended from Martha Washington—my mother had letters and jewelry that had belonged to her. When I found a genealogical chart in C. S. Wilkinson's *The Wake of the Bounty* showing that Thomas Law had married George Washington's step-granddaughter, I knew she had to be the daughter of John Parke Custis, who is my great-great-great-great-grandfather.

It has been said that Christian went to sea, broken-hearted, because his great love, Isabella Curwen, had abruptly married his cousin John. Years later, Christian would give to his Tahitian wife, Mauatua, the name Isabella.

We also know that Christian was an able seaman, explorer and navigator, for after the mutiny he sailed his undermanned ship 8,000 miles around the South

Barnaby Conrad's most recent book, Time Is All We Have: Four Weeks at the Betty Ford Center, *will be released by the Dell Publishing Co. in April.*

Oldest house on Pitcairn belonged to Thursday October Christian, first son of Fletcher and Mauatua.

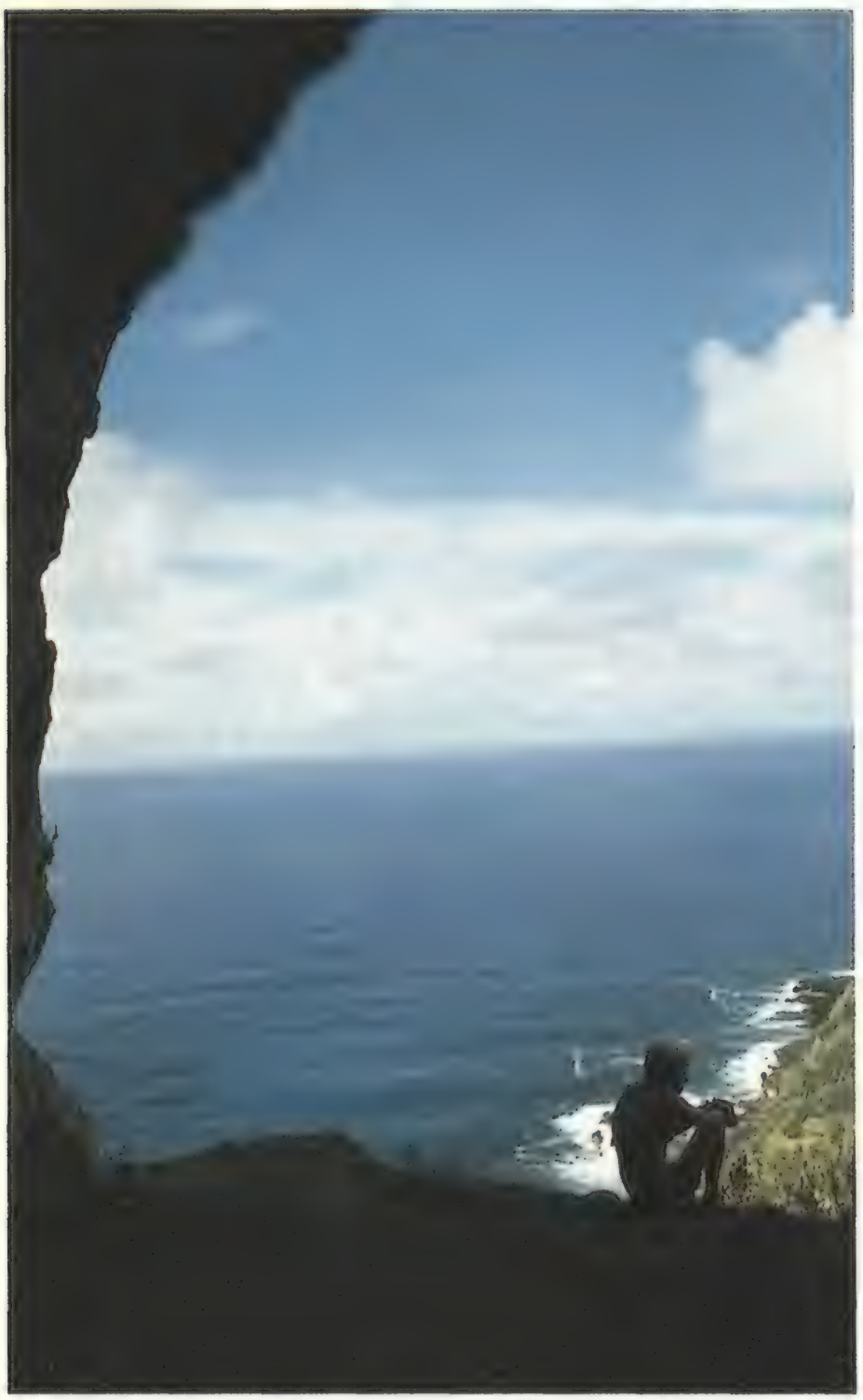
Isolated island of Pitcairn has only one landing spot along its rugged coastline. Here in Bounty Bay, in 1790, Fletcher Christian and his party came ashore, then sank their ship. Today, about 500 visitors a year are lured by the *Bounty* legacy to this remote paradise.

Pacific and found Pitcairn, which had been mischarted by 200 miles. Only one mile wide and two miles long, the great hunk of rock rising 1,000 feet out of the sea was lush and uninhabited and had plenty of water. Within days the mutineers' party had stripped the *Bounty* and burned it, intending never to leave.

But of course no one in England knew where they had gone. The crew members who had debarked in Tahiti were discovered by the British, who tried them back home as mutineers. Three were hung. And thus began decades of speculation about the fate of Christian. Most people assumed the ship had been lost at sea. Then, six years after the mutiny, an extraordinary pamphlet called "Letters from Mr. Fletcher Christian" was published. Its contents had purportedly been written by the mutineer in Spain and described how he had been shipwrecked off Chile and how he planned to return to South America. Bligh's reaction was icy: "Mr. Nicol [Bligh's publisher] has been so good as to send me down a pamphlet called Christian's Letters. Is it possible that wretch can be at Cadiz? . . . I can only say that I heartily despise the praise of any of the family of Christian, and I hope and trust yet that the Mutineer will meet with his deserts."

Only in 1808, eighteen years after the *Bounty* had disappeared, did the outside world learn anything about the mutineers' fate. An American ship, the *Topaz*, passed near Pitcairn looking for whales. "On approaching the shore saw a smoke on the land, at which I was very much surprised, it being represented by Captain Carteret as destitute of inhabitants," the *Topaz*'s captain later reported to the British. "I went on shore and found there an Englishman by the name of Alexander Smith, the only person remaining out of the nine that escaped on board the ship *Bounty*. . . ." (Alexander Smith was an alias that mutineer John Adams had assumed.)

"All the children of the deceased mutineers speak tolerable English," the report continued; "some of them are grown to the size of men and women and, to do them justice, I think them a very humane and hospitable people; and whatever may have been the errors or crimes of Smith, the mutineer, in times back, he is at present a worthy man and may be useful to navigators who traverse this immense ocean. . . ."



This is Fletcher Christian's cave on Pitcairn Island: "... he'd go up there and brood for long times at a go."

Adams was the sole remaining mutineer

The population of Pitcairn, 25, was made up mostly of children and teenagers. The only adult women were four Tahitians. Adams, who was in his early 40s, was indeed the sole remaining man.

The captain of the *Topaz* told Adams what had transpired in the outside world since the mutiny—how Bligh had survived the incredible voyage to Timor in his open boat; how the crew members who had elected to stay on Tahiti had been captured; and about the celebrated trial and hangings back in England.

Naturally, the captain was curious about the fate of Fletcher Christian and the other 13 Pitcairn men. But Adams, an evasive character, related several versions of what had happened to Christian (which he repeated to the captains of two more ships that visited a few years later). One account was that Christian had been killed by the Polynesian men in a dispute over the women. But where was his grave? Adams couldn't—or wouldn't—answer that. Other explanations: Christian went insane shortly after arrival on Pitcairn and threw himself into the sea; or, after some harmonious years Christian became sick and died, and the rest of the

men massacred one another, all except for Adams.

Because of this confusion, various theories were floated during the following century as to the real fate of Fletcher Christian. Some argued that, indeed, Christian had never left the island. For example, in a book published in 1898 called *The Mutineer*, an adventurer claimed to have visited Pitcairn where, he said, the islanders had told him the real story. Christian, he reported, had been wounded by the Polynesian men but had recovered, and had subsequently tried to put to sea in one of the *Bounty*'s boats to join a passing sailing ship. Adams tried to prevent him from leaving, to protect the secrecy of the community; in the struggle he shot and killed Christian. This would explain Adams' various stories—he did not want it known that he was Christian's killer, even accidentally. The book said that Christian, before dying, asked to be buried in an unmarked grave; he did not want people to point out the grave of "the mutineer."

Another popular theory held that Christian had left Pitcairn. Writing in 1831, Sir John Barrow argued that he was living incognito back in England. "About the years 1808 and 1809," Barrow wrote, "a very general opinion was prevalent in the neighborhood of the lakes of Cumberland and Westmoreland, that Christian was in that part of the country and made frequent private visits to an aunt who was living there." Not only that, he continued; at about the same time, a former midshipman on the *Bounty* had run into a man on a Plymouth street who he was certain was Christian, but the man had successfully outrun him.

More than a century later, in 1953, Wilkinson expanded on this theme in his book *The Wake of the Bounty*. Christian did return to England, he wrote, where he met Coleridge through their mutual friend, poet William Wordsworth. And Coleridge based his epic, *The Rime of the Ancient Mariner*, on Christian's story. It is true that many of the exploits of the Mariner seem to parallel those of Christian and the *Bounty*, and in one of his notebooks Coleridge mentioned the "adventures of Fletcher Christian."

Could Christian have escaped from Pitcairn?

We do know that at least two ships in the seal and whale trade passed not far from Pitcairn during those years. Could not Christian have approached one of them in a *Bounty* boat, paid handsomely with gold from the large amount the *Bounty* had been carrying (not a farthing of which has ever been found) and sailed to North or South America and perhaps home?

Traveling by plane and cruise ship to Pitcairn, I had plenty of time to wonder whether any further clues about Fletcher Christian's later life would emerge. One day at 6 A.M., after the ship had finally

Copper nails from *Bounty*: they've been a popular souvenir item since sunken ship was located in 1957.

Pitcairners keep Fletcher Christian's Bible, given to him by his mother, in the island's sole chapel.

Cannon is one of several artifacts from the *Bounty* that are displayed around Adamstown's public square.

In British print done in 1790, one year after mutiny, upstart seamen are hardly seen in heroic terms.

anchored off the island, my companions and I climbed into a small, inflatable boat piloted by Brian Young, a Pitcairn native. He is the sixth-great-grandson of mutineer Edward Young. With a roar of the outboard we headed for Bounty Bay, where gigantic waves crashed on the boulders that guarded our supposed landing place. I glanced nervously at Brian, but he appeared unworried. "Weel-com to Peet-kern," he boomed heartily. "Yonder be Bone-ty Bay!"

Bay? All I saw dead ahead was a dent a little larger than a swimming pool among huge black boulders. No wonder Pitcairn is the most unvisited famous island in the world. "Doon't be alarmed," Brian said; "we've a werry calm sea today." As we drew closer, he slowed the boat and we rocked on great swells, waiting for the right series of waves to take us in.

Pitcairn! How exactly right it looked, this menacing monolith with long gashes of blood-red and ocher earth on its sides. "There is a spectral mood about the place," one writer has said, "a quality of eeriness and brooding in the landscape." I looked over at Brian studying the breakers with squinting black eyes. Finally he shouted "Now!" and gunned the outboard.

The little boat sprang forward in front of a great swell; we caught it and were propelled toward the pass. We surfed down the steep side of the breaker for a hundred yards and swept into the small opening between the boulders; Brian veered the craft sharply to the left and we glided alongside a concrete jetty.

Nearly all the islanders were on or around the landing place; because fewer than 500 visitors a year land on Pitcairn, a ship's arrival is a great event. We were helped from the boat by eager, friendly hands and I had my first look at these smiling people, nearly all descendants of the original dozen Tahitian women and the mutineers.

The first surprise was how tall and healthy the islanders looked. They were dressed in ordinary island garb—shorts and shirts and dungarees and Mother Hubbards. Some wore T-shirts with "Pitcairn" printed on them. Most were barefoot—and their feet were enormous.

There were several booths set up near their three 36-foot longboats and here the women and children sold beautifully carved birds, fish, canes—and models of the *Bounty*. The skill had not been passed down from the British seamen but rather had been learned from an Austrian wood-carver around the turn of the century. Sold unbelievably cheaply considering the amount of skill and time involved, the carvings are, along with the sale of postage stamps, the island's chief source of revenue. Nearly everyone on the island is or will be a wood-carver. The semiannual trek to Henderson Island, 106 miles away, to harvest the rare miro wood for the carvings is an important event on the Pitcairn calendar—and not without its dangers. Not only is the long trip in unpredictable seas risky, but the waters around Henderson teem with sharks. As proof, I was introduced to Nig Brown, the island's one—unnecessary—policeman, whose hand was bandaged from a shark bite on Henderson the week before.

Taking liberties with the saga, Hollywood portrayed Fletcher Christian as a noble underdog in a series of film versions. Stars who have played him include, from left, Clark Gable, Marlon Brando, Mel Gibson.

"Totally m' fault," he said, somewhat sheepishly. "We caught this here 12-footer; I thought he was quite dead, stuck me hand in his mouth for a photo and he comes back t' life!"

Pitcairners, I soon noticed, have two languages. One, which they speak to visitors, is a rather correct, yet quaint English with overtones of New Zealand, where most of them go for two years of schooling. The other, which they speak among themselves, is a mixture of 18th-century English and Tahitian. "Humuch pebble levan on Peet-kern?" means "How many people live on Pitcairn?"; and "Humuch shep cor ya?" means "How often do ships call?"

I bought a fine model of the *Bounty* with wooden sails. On its deck a bonus was placed—a square, salt-encrusted nail from the wreck of the *Bounty*.

"She lies right over there," said Nig, pointing down the rugged coast, "right alongshore where Fletcher burned her. She's only in 40 feet of water and on a calm day we can dive down for the nails. Her anchor and rudder have been raised, and a couple of cannon. There's a gun still waiting to come up that we can see, all encrusted."

Brian provided a lift on his three-wheeled motorbike up the steep path to the settlement. Once up on the Edge, as the top of the cliff is called, it's a half-mile to Adamstown. Flowers and fruit are everywhere: bananas, guava, papaya, grapefruit, lemons, oranges, sugarcane and coconuts. And, of course, breadfruit. (The *Bounty* had been sent to gather breadfruit trees, which would be taken to the West Indies to supply cheap food for England's slave laborers there.)

Adamstown is barely a town. Its dirt road, bordered by half-hidden houses, leads through the public square, where the church, the court, the dispensary, the post office and the business office are clustered. In front of the courthouse, two children were playing on an anchor from the *Bounty*, recovered after a National Geographic Society expedition found the ship's remains in 1957. Virtually every place one goes on Pitcairn one is reminded of that ship. A cannon is prominently displayed along the road; Fletcher Christian's Bible is still used in church services. Beside it is exhibited, incongruously, a copy of Bligh's marriage certificate. Religion is important here; the Pitcairners have been fervent Seventh Day Adventists for 100 years. I'd heard that they also had a good sense of humor, which was confirmed by a sign near the post office that read: "Don't forget the boat race on Sunday! Winner to receive a weekend on glorious Pitcairn Island!"

Brian introduced us to Andrew Young, the bearded patriarch of the island, who was dressed in a bright-red aloha shirt for the occasion. Tall, active and amazingly healthy at 88, he is a descendant of both mutineers Young and Christian.

We sat on a bench in the square and Andrew said cheerfully that he intends to become the oldest man ever to have lived on Pitcairn. "Ah knew Duddie, y'know," he said, a slight, almost Scottish curl to his words. "He was 91 and I intend to outlive him!" He seemed pleased that I knew he was referring to Thursday October Christian the Second, Fletcher's grandson, who died in 1911. "Duddie used to tell me wonderful stories. He knew Isabella, or Mauatua—his

Mutineer descendants Bernice Christian and Andrew Young are living repositories of the island's history.

grandmother, Fletcher's wife—also called Mainmast, that 'cause of her height, y'see. She lived till he was 20 and she told him of the bad early days and he told them to me. Were a gud old man, old Duddie were."

Those bad days were, indeed, horrendous. At first, Pitcairn was the Eden that Fletcher had envisioned. "But the six Tahitian men were treated like slaves, y'see," said Andrew, his gnarled hands folded over the carved head of his cane, shaped like a frigate bird. "They were not allowed to own land and after a few years there were quarrels over the women."

The upshot, Andrew continued, was that the Polynesian men killed some of the mutineers, including Fletcher Christian, and the remaining mutineers in turn killed them with the connivance of the women. Four years after landing, only the men named Young, Adams, Quintal and McCoy, and the women and children were left. Then liquor became a problem when McCoy, who had once worked in a distillery in Scotland, discovered how to brew a potent alcoholic drink from the roots of the ti plant. Quintal went berserk on the liquor and was killed by Young and Adams in self-defense. McCoy jumped drunkenly off a cliff into the sea, a rock tied around his neck. Adams, who had also become an alcoholic, experienced a religious vision and quit drinking.

That left Young and Adams. Then Young died of asthma, leaving Adams sole male survivor of the original party ten years after they'd landed. In his care were 10 women and 23 children. "Come along," said Andrew, "and I'll show you his grave, if you've a mind."

As we walked, he talked about the decline in population. "We don't have children the way we used to for some reason. Once there were 200 people on Peet-kern. But gradually we've dropped down to 48. The young ones go off to New Zealand to study, then some don't want to come back. Can't say as I blame them. Peet-kern is paradise, but there's not a lot to do in paradise."

We came to Adams' grave, a simple headstone surrounded by plants and bright flowers. "Luckily for us," said Andrew, "Adams set the standards early on for being industrious and good Christians, and although he had limited education himself, he taught all his descendants to read and write from the *Bounty* Bible." Behind the grave at the end of the island, a great finger of rock rises hundreds of feet in the air and is capped by a 20-foot gouge at the top. "That be Fletcher's Cave," said Andrew. "His wife told Duddie that he'd go up there and brood for long times at a go."

I told Andrew that I'd read an account claiming that Fletcher had managed to get off Pitcairn with a passing whaler and had returned to England.

"Poppycock!" said Andrew. "Fletcher's wife, Mainmast, told Duddie that Fletcher was one of the first killed by the Tahitian men!" "But where's his grave?" I asked. "Ah," said Andrew frowning, "that." "He must have a grave somewhere," I pressed. "He's probably buried under the courthouse with the other men murdered at that time. At least, we think they're buried there." "Strange their leader's grave wouldn't be marked," I countered. Andrew didn't answer. I told him about my ancestor's daughter marrying into Fletcher's family. "That would be his cousin Thomas Law," Andrew said. "Married to the granddaughter of George Washington."

A fragile paradise with too few children

We walked up to the airy little school, which the 13 children attend. Judy and Lloyd Buckley teach and put out the monthly newsletter, "Miscellany" (pronounced miss-SELL-any). They are not Pitcairners; they're here on a two-year assignment from the New Zealand government, which administers Pitcairn affairs for the British. Lloyd was pessimistic about Pitcairn's future. "It's a fragile paradise indeed," he said, "with the young people leaving and not enough children being born. We're down to 12 able-bodied men. It would be almost impossible to maintain the island with any fewer. There has been some new blood—Brian Young's wife, Karen, who arrived from Norway a few years ago, for example, and has two fine children. She came, incidentally, because she claims she'd seen the movie and was looking for Clark Gable. Brian's no Clark Gable, but he's a fine fella."

"What do people do all day on this tiny island?" I asked him. "Do? Why, there's plenty to do always. They weave and carve and mend the boats and bake bread and eat—Lord, how they love to eat! And they plant and harvest and gather firewood and tend the

INDULGENT. THE SENSE OF REMY.

Rémy

cemetery and fish and when the chores are all done there's the ham radio and a closed-circuit TV."

We were shown most of the rest of the island and each place seemed to have a story. The oldest house belonged to Fletcher Christian's son, Thursday October Christian. Vine-covered, white with age, the two-room shanty was made from some of the *Bounty*'s planks and though uninhabited now, it remains in fair condition. All the colorfully named landmarks that we passed had their stories: No Guts Captain (the burial spot of a seaman whose embalmed body found its way to Pitcairn); Where Minnie Off (the spot where a great-granddaughter of Christian was swept into the sea by a huge wave); Bang On Iron (the site of the original forge), and so forth.

The church bell rang and it was time to go back down the Hill of Difficulty to the boats. The captain of the cruise ship had invited everyone who lived on the island—the 48 descendants of the mutineers and the 20 others, like the Buckleys and the pastor and his wife—for lunch. Afterward all 48 Pitcairners sang for us in the main saloon. I remember years ago Sterling Hayden, the late actor-adventurer-author, telling me, "When you hear the Pitcairners sing their good-bye songs, everyone cries." Now, at the end of the afternoon as I saw the shining faces of these gracious people, survivors all, raised as they sang their rendition of a simple hymn, I felt a catch in my throat:

> In the sweet bye and bye,
> In the beautiful land beyond the sky
> . . . we shall part
> Never more, when we meet
> On the be-yoo-tee-fool shore. . . .

I stopped Andrew before he went down the gangplank, and tried one last time. "Do you think there's any possibility that Fletcher left the island?"

He shook his head vehemently. "Then Mainmast would not have been tellin' the truth to old Duddie, would she now!" And the subject was closed.

"Maybe I'll see you next year," I said.

He shook my hand in both of his. "No," he said with a sad smile. "People only come to Pitcairn once. Good-bye—cousin."

Members of the newest generation frolic in the surf of Pitcairn Island's only stretch of beach. Old-timers worry about the future of the mutineers' haven, where the population has dropped to 48 from a high of 200.

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Syncopated sounds of Cajun country music were born in the moody, misty swamps of South Louisiana.

Though the center of the music scène has shifted to the prairies, its roots remain firmly in the bayous.

By Jim and Carlotta Anderson

The good times are rolling in Cajun country

The rollicking rhythms of Cajun and zydeco music have come a long way from Louisiana, winning fans and followers around the world

Near the hamlet of Erath, Louisiana, pop. 2,148, split down the middle by the railroad tracks and Route 14, D. L. Menard—owner and proprietor of the one-family Menard Chair Factory—sits in the kitchen of his small, weathered frame house. He is lean and ruggedly handsome at 55, despite jug ears and a couple of missing front teeth. Rocking on one of the platform chairs he makes out of local ash wood (price $39, or $49 if you choose the deluxe version with handwoven rush seat), he slaps the armrest with the Gallic animation seen hereabouts. "We didn't pay no mind to what we had until others made us aware," he marvels. "Now we're known the world over. And the only place you can find this sound is right here in Cajun country."

The "sound" Cajun guitarist Menard refers to is a homegrown folk music once found only in the remote byways of South Louisiana, not far from the Gulf of Mexico. What the people "had" and had clung to tenaciously for generations was a French language, a unique, rollicking music and a spicy-hot cuisine, which have all escaped—so far—being melted in the great American pot.

Once gasping, this curious, exotic culture now seems ruddy-cheeked with health. The French dialect is no longer banned in schools and a Cajun dictionary has been published. Americans are savoring the spicy dishes popularized on television by chef Paul Prudhomme and now featured in restaurants nationwide. Throughout the world, people are dancing to the fiddles, accordions, guitars and plaintive French lyrics of Cajun waltzes, jigs and two-steps, as well as to the music of its black, French counterpart, zydeco.

The current trendiness of all things Cajun is a source of amazement to D. L. Menard. Time was when there was no call for his music apart from Saturday night dances for the local Acadians (or Cajuns), descendants of settlers who found their way here from Nova Scotia (then called Acadia) in the middle of the 18th century. Even locally, the archaic and heartfelt tunes were seen as an embarrassing throwback to the country bumpkin ways of the past and sneered at as "chank-a-chank" music. Branded by local stigma, the old French culture seemed doomed.

Self-appointed ambassador and spiritual godfather of Cajun music, Dewey Balfa, fiddler extraordinaire, performed at the 1964 Newport Folk Festival and helped pave the way for the revival of Cajun music.

Photographs by Philip Gould

D. L. Menard, composer, musician, chairmaker, strums a few chords while relaxing at his chair factory in Erath. An important and creative composer, Menard began playing at 16. It's rare to hear a performance of Cajun music that doesn't include one of his tunes.

What hand reached into this isolated pocket of old-France-in-America and laid out its delights for the world to enjoy? Partly it was those Americans who, in the mid-1960s, started searching for roots. They were looking for the unspoiled folkways that told the story of America's heritage and evoked images of earlier, less-troubled times. Folk-music festivals began to flourish and their scouts sought out unknown musicians with new and exciting styles. A charismatic fiddler and singer named Doug Kershaw from Jennings, Louisiana, introduced pop Cajun music on national television. Later, fans of *A Prairie Home Companion* heard the Cajun band Beausoleil play at Lake Wobegon. Moviegoers followed the exploits of a 19th-century figure in *Belizaire the Cajun*, a 1986 release, and more recently were swept along by the syncopated soundtrack of the film *The Big Easy*. Diners who had tired of quiche and pasta salad acquired an appetite for blackened redfish or chicken jambalaya. As things developed, this once insular region climbed out of obscurity and, in the words of Washington, D.C. music promoter Marc Gretschel, "It became hip to be Cajun."

To get to D. L. Menard's very unhip kitchen, you leave behind the somewhat-tarnished, theme park atmosphere of New Orleans' French Quarter and head west. Interstate 10 takes you past the marshland and fishing shacks of Lake Pontchartrain to the looming tanks and towers of the oil refineries at Baton Rouge on the Mississippi. You continue on the elevated Swampland Expressway through the vast Atchafalaya Basin, moody and mysterious with its ghostly cypress stumps jutting up from the dark waters.

This is not the South of pillared front porches, magnolia trees and mint juleps. It's hardscrabble country, with the somewhat dilapidated frame houses and rusting trailer homes of poor folks set in the moist, black earth by the rice fields and cattle pastures of the Louisiana prairies. As you approach the neat suburban sprawl of Lafayette, the hub of Cajun country, your feet tap to the beat of local music sung in a twangy, rather tuneless shout on the car radio: "*O bébé, on va danser, / Danser, danser le jig français / Comme les temps, les temps passés.*" Now a two-lane blacktop takes you south to Erath, about 15 miles from the Gulf of Mexico and a three-hour drive from New Orleans.

D. L. (he's never called anything else, perhaps because his given name is Doris) can be found by counting to the fifth mailbox after the bridge over the bayou and looking for the red house next to the yellow winch truck. Menard has performed throughout the United States and in 17 countries he never dreamed of seeing. Yet he remains reluctant to leave—even for short tours—his family of six sons and a daughter, his wife, his chair factory, his roots.

D. L.'s wife, Lou Ella, a rotund woman who speaks with the same soft French accent, waits on the front porch and leads the way to the kitchen. Menard comes in from the nearby chairworks, a small, sagging shed covered with corrugated tin. Despite the glamorous pose in a glitzy cowboy outfit on his latest album cover, Menard remains unspoiled by international attention.

The music business is expanding, but otherwise

Jim and Carlotta Anderson live in Glen Echo, Maryland. They first heard zydeco music played at a local dance hall, traveled South to learn more.

times are tough now in Cajun country, Menard says. Since the oil boom went bust three years ago, two of his sons were laid off from jobs on oil rigs in the Gulf and other jobs are scarce. D. L.'s chairs are selling well, though, "better since the economy went bad 'cause a lot of people can't afford to buy a whole set at the store." Lou Ella and daughter Rebecca weave the rush seats. Chair making is how Menard has made his living for the past 20 years; like most Cajun musicians, he can't support himself from his music.

But tough times are nothing new in the swamps and prairies of South Louisiana. "Most of us was raised poor and worked hard," he says. "We had to amuse ourselves with things that didn't cost too much and music was one way of letting loose." Many Cajun songs are about sorrow, loneliness, death and lost love. "They pop into your head most when you're in a sad mood," says Menard, who has written some of the best-known modern Cajun songs. He was 16 and working in the sugarcane fields around Erath when he bought his first guitar from Montgomery Ward in 1948. While pumping gas at a local filling station, he jotted down the words of a rousing tune called "*La Porte en Arrière*" (The Back Door). It became so popular that some refer to it as the Cajun national anthem.

Menard sings in the strident, nasal "holler" characteristic of the traditional Cajun style. He uses the local dialect—a mingling of French with Indian, English, Spanish, German and African elements—in his songs, which pleased his father, since "Daddy couldn't speak any English." But it appeared to limit his potential audience to the 900,000 or so Louisianians of Cajun ancestry living in the 22 southernmost parishes (counties) of the state.

In 1916, Louisiana's Anglo-dominated government began officially prohibiting Cajun children from speaking French at school, in an effort to mainstream and Americanize them "for their own good." Until fairly recently, the Cajun ways were ridiculed and its people considered hicks with backwater habits. Now the state's schools are focusing on teaching French—what the local people call "Parisian French," that is. And the state tourism bureau, recognizing the economic value of the culture, is displaying Cajun country like a long-buried treasure.

The transformation began slowly. In 1964, Dewey Balfa (p. 113)—a sharecropper's son from Louis, in Evangeline Parish—was invited to perform at the Newport Folk Festival in Rhode Island. The field-worker who found him and who became a key figure in the revival of Cajun music was folklorist Ralph Rinzler, later director of the Smithsonian's Folklife Program and now the Institution's Assistant Secretary for Public Service. Playing songs learned from his father and

Buckwheat Zydeco plays his piano accordion at Lafayette nightclub.

Marc Savoy (left), Harry LeFleur jam in weekly session at music store.

grandmother, Balfa brought his unaccompanied ballads and soulful fiddle tunes to cheering, sophisticated crowds who spread the word. He went on to become one of the leaders of the renaissance of Cajun music and culture. In France, too, the music was "discovered." Since then, scores of Cajun musicians have performed at nightclubs and festivals (including repeat performances at the Smithsonian Festival of American Folklife) and have gone on tours around the world. Beausoleil, the most famous young Cajun band, is on the road nine months of the year. They drew a sellout crowd to Carnegie Hall in 1985 and just last November had an overflow throng dancing in the streets outside their concert in San Francisco.

To Cajuns, their music is much more than entertainment. It is a link with a treasured but tragic history. Menard speaks of the exile of the Acadians from Nova Scotia, *Le Grand Dérangement*, 233 years ago, with a sense of unreconciled injustice and pain. In a mass deportation executed with cold ruthlessness, companies of red-coated British soldiers collected thousands of men, women and children in 1755, packed them into boats and shipped them to widely dispersed locations.

The forefathers of today's Cajuns were people of rural stock who had migrated from northwest France to the French colony of Acadia in the early 1600s. There they had developed a thriving existence farming, fishing, hunting and trapping among the "murmuring pines and the hemlocks" of Longfellow's vivid epic poem *Evangeline*.

In the mid-1600s the French and English began their long struggle for possession of the North American continent. The British captured Port Royal, the seat of the Acadian government, in 1710. Three years later, the Treaty of Utrecht, signed 3,000 miles away, decided the fate of the Acadians by handing the territory over to Britain. Intent upon maintaining their

At Mulate's in Breaux Bridge, a busy supper club and dance hall, both the food and music are authentic.

Local regulars flank favorite table at Bourque's Club, old-time dance hall off tourist track in Lewisburg.

Its convivial setting allows locals and growing numbers of tourists to mix in the spirit of Cajun good times.

Beausoleil performs at Mulate's as couples take to the dance floor for snappy two-steps and waltzes.

French culture and identity, most Acadians refused to take an oath of allegiance to the British Crown.

In 1755, during the French and Indian Wars, the deportation began. Acadian farms were destroyed or confiscated. Families were sometimes separated, crying out as their loved ones sailed away. With only the possessions they could carry, they were scattered along the Atlantic Coast from Maine to Georgia, and even to distant ports in the West Indies, Europe and the Falklands. As Longfellow described it in *Evangeline*:

> Friendless, homeless, hopeless, they wandered
> from city to city,
> From the cold lakes of the North to sultry
> Southern savannas—
> . . . many, despairing, heart-broken,
> Asked of the earth but a grave. . . .

Evangeline, searching over the years for her lost love Gabriel, floats with a band of exiles down the Mississippi, hoping to reach Louisiana, the French outpost to the south. There, along the banks of Bayou Teche near the present-day town of St. Martinsville, they find the "promised land," a settlement of friends and companions where they can live undisturbed. In this land of prairies, bayous and swamps, the Acadians found an environment that would provide a livelihood for their wandering tribe and a natural barrier behind which they could create a new Acadia.

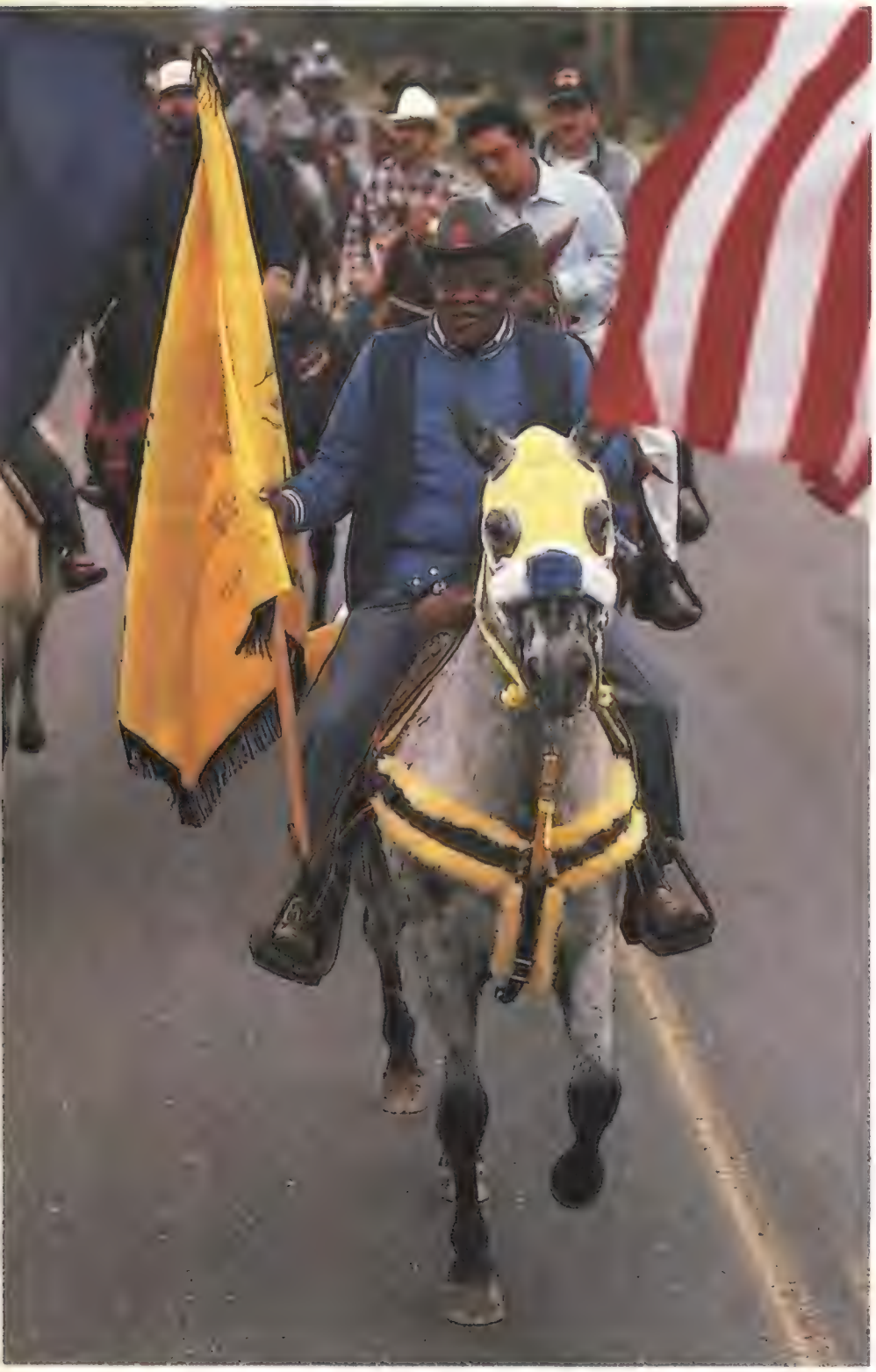
Moisture is so much a part of lower Louisiana that it has been said the land seems unable to decide whether it will be earth or water. Houses are built on cement posts because the water table is so close to the surface. The rice crop thrives, and now that the lowly mud-bug has been transformed into the gourmet crayfish (crawfish in Cajun country) and has produced a thriving industry for the region, it is often farmed in the same fields as the rice.

The marshy wilderness of the Atchafalaya Basin, extending 75 miles north from the Gulf of Mexico, is now the heart of the crawfish and sportfishing industries. A great, wild woodlands in perpetual dusk, its ancient cypresses and black willow trees are draped with Spanish moss. This ghostly wonderland is home to alligators, beavers, otters, muskrats, great white herons, water moccasins and a few Cajun "swampers" living in "camp cabins" or modest houseboats. Despite its many dangers and insects, the land offered a living to the early trappers and settlers; even the eerie Spanish moss was harvested to stuff pillows and mattresses. So insular did the society become that the people called themselves *Cadiens* and referred to those outside their culture as *Américains.*

For these country people, Saturday night was the opportunity for a weekly get-together and dancing was always part of the festivities. For more than 50 years

now, accordionist Octa Clark and fiddler Hector Duhon have been keeping dance floors hopping with exuberant two-steps and lilting waltzes. At Mulate's, a popular restaurant and dance hall in Breaux Bridge, they perform in shirtsleeves, sitting in front of a mural of a swamp cabin, looking like anyone's grandfathers.

Whole families sit at long tables covered with checkered tablecloths, savoring foods taken from the water—stuffed crab, fried catfish, crawfish in every conceivable form, laced with hot sauce and washed down with cold beer. Conversations are an animated mix of Cajun French and English. Everyone dances, even the small children. The place is jam-packed and noisy. A bit raucous, the customers obey the classic Cajun admonition to "*Laissez les bons temps rouler*" (Let the good times roll).



Boozoo Chavis of the Prien Lake Trail Club rides an Appaloosa on one-day outing near Lake Charles.

Octa Clark, 83, has been playing his "squeeze-box" since 1928. This Cajun button-type accordion, which probably arrived here with German immigrants in the 1850s, is less assuming than the large, pearly, more familiar piano-key models. Like a harmonica, the instrument has a full tonal range in a single key. Each button produces two notes, according to whether the bellows is being pushed in or pulled out. Once the instruments were imported, but currently there are about 30 accordion builders in South Louisiana. Nowadays most bands also include guitar and drums; years ago, however, the accordion and fiddle were the main instruments, joined by a steel triangle (*'tit fer*, little iron) to accent the beat.

Over at Prejean's in Lafayette this particular week, D. L. Menard and two fellow musicians are performing honky-tonk tunes while dancers order gumbo or maybe fried fillet of alligator (tastes a bit like fowl). At Randol's, a greenhouse during the day and a dance hall at night, Sterling Richard, at 27 one of the few young Cajuns playing in the old, traditional style, is performing with his father, Felix. Leaning over a heaping serving of boiled, highly spiced crawfish, Richard explains why he sings in an unnaturally high, almost falsetto wail, reminiscent of flamenco music: "We have so much sorrow that we just have to holler, and that's how it comes out."

"The most complete voice of the Cajun people"

Richard's inspiration is a legendary, near-blind accordionist, Iry LeJeune, who is credited with reviving the almost-forgotten early style of Cajun music in the 1940s when Western Swing had replaced it in the dance halls. LeJeune's songs tell of a time that is troubled and lonely, when poverty and desertion delineate life, but when the occupants of the harsh landscape have consolation in each other and in their common heritage. His haunting lyrics, Cajun music historian Ann Savoy writes in *Cajun Music: A Reflection of a People*, "are the most complete voice of the Cajun people ever recorded." Iry died at the age of 26 in 1955, at the peak of his career. He probably never saw the car on a country road near Eunice that killed him as he helped fix a flat tire on a foggy October night. The local newspaper, reflecting public indifference to the traditional culture, described LeJeune, the premier Cajun poet-accordionist of his time, as "a well-known hillbilly musician."

In Louisiana, the Cajuns are not the only people with a tragic heritage. The black Creoles, another French-speaking group living in the same territory,

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Dancers stir up the dust at the Festival Acadiens in Lafayette. An annual event since 1974, the festival is held every September in a local park. A celebration of Cajun culture, it offers food, crafts and music.

are descendants of slaves torn from their homes in West Africa to clear land and otherwise enrich the Louisiana planters. The Creoles share with the Cajuns a French-language culture and a Catholic religion, but their Afro-French idiom is sometimes more like the Haitian dialect. Their music draws on their own history of slavery and economic hardship, when they were excluded from Cajun society and to some extent from black English-speaking society as well.

Some of the greatest players of Cajun music were (and are) black, and played together with white musicians. But the Creoles also developed a musical style all their own, called zydeco. Like Cajun, it is "roots" music, though a mixture of many elements. Explains Stanley (Buckwheat Zydeco) Dural, one of its most popular stylists: "You add a little blues, a little soul, a little rock 'n' roll, a little jazz and mix it all in. Sometimes you can hear five different types of music in one song."

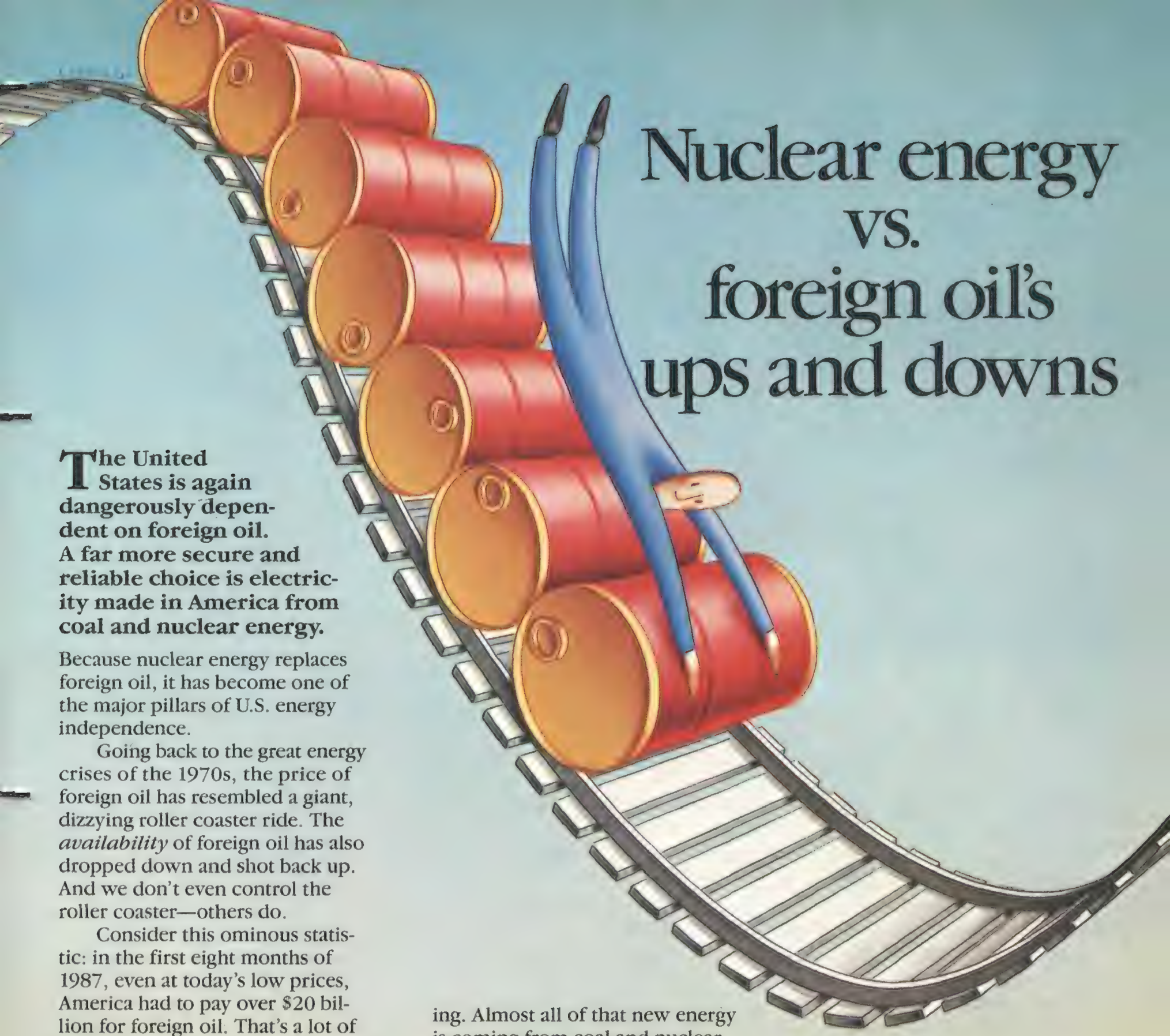
With its strong, syncopated beat, zydeco music is hard to sit still to. Dural's band is called Ils Sont Partis (They're Off and Running). The music is snappy: "That's why it's called zydeco—they're snapbeans which break and pop," Dural says. "At least that's sort of how you pronounce *les haricots* down here."

Even with good directions to a zydeco dance hall, you're apt to miss it. Like dozens of other roadside night spots dotting the countryside of South Louisiana and East Texas, it's just a long, low, mostly windowless building of frame or corrugated metal with a large, dusty parking lot and perhaps some cows grazing in the field next door. There might be no sign at all or maybe a garish orange signboard with movable plastic letters—a generic device also used to advertise cockfights or catfish dinners. This Saturday at Hamilton's outside Lafayette the sign tells you Sampy and the Bad Habits are playing.

Hamilton's decor is "early functional," consisting of four walls, a bar and scattered wooden tables with chairs crammed together in the darkness. The percussive sounds roaring through the amplifiers are a far cry from the more melodic rhythms played by the white, three-piece Cajun band down the road, although you can still hear the old, country dance beat in some numbers and there are plenty of waltzes.

The couples stepping fast and smooth on the dance floor are mainly middle-aged and prosperous-looking (the admission of $5.50 per person is considered high) and they are all black Creoles. The men, some in cowboy boots and feathered cowboy hats, and the women, in party dresses of prints and satin, execute a tricky dance step to numbers like "*Quand Mo Perds Ma 'Tite Fille*" (When I Lost My Little Girl) and "*J'Suis Un Récolteur*" (I'm a Farmer).

As in Cajun music, the accordion is a focal instrument, but here it's an elaborate piano accordion and the fiddle has disappeared, its lively lilt replaced by the blast of a saxophone or trumpet. Gone, too, is the



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USCEA 1988

Dopsie jr., son of zydeco accordionist Rockin' Dopsie, plays cowbell and kicks up his heels at zydeco fest.

triangle. In its place is an instrument that reflects similar lean musical beginnings, when the rhythms might be tapped out with spoons or even dried animal bones. Called a rubboard or *frottoir* and evolved from the laundry washboard, it's a kind of corrugated-steel vest hung over the shoulders and scraped with thimbles, spoon handles or bottle-cap openers to provide the insistent rhythm that drives the band.

One of the first black Creoles to play the piano accordion and the one who developed "*la-la*" music, as it was then called, into what we now call zydeco was Clifton Chenier (p. 125), accompanied by his brother Cleveland on rubboard. By the mid-1950s, Clifton received nationwide attention with recordings of "*Ay Tee Fee*" (Hey Little Girl) and "Bopping the Rock," and started touring the country and later the world. As the King of Zydeco, Chenier used to perform with a crown on his head. To play the intense blues of zydeco, he once told Louisiana writer Ben Sandmel, you've got to have experienced hard times, been "through the mill." Of today's music, he continued, "They ain't got no story for you 'cause they ain't been through nothin'; they ain't been nowhere yet." His death in December, says Smithsonian folklorist Nicholas Spitzer, "signaled the end of an era. The king is dead, but in his students and followers he has left many heirs to the zydeco throne."

This Saturday night's dance at Hamilton's is part of a more elaborate tradition among both blacks and whites: a trail-ride weekend. By Sunday noon the dancers, joined by their families, can be found in the middle of a cow patch readying their spirited horses for a mass ride through the countryside. Men whose denim jackets identify them as members of "Maurice CC Riders" or "Dipsy-Doodle Ruff Riders Club" hitch up sulkies or hay wagons for the women and children. This movable festival brings hundreds of horses and Creole cowboys from as far off as East Texas.

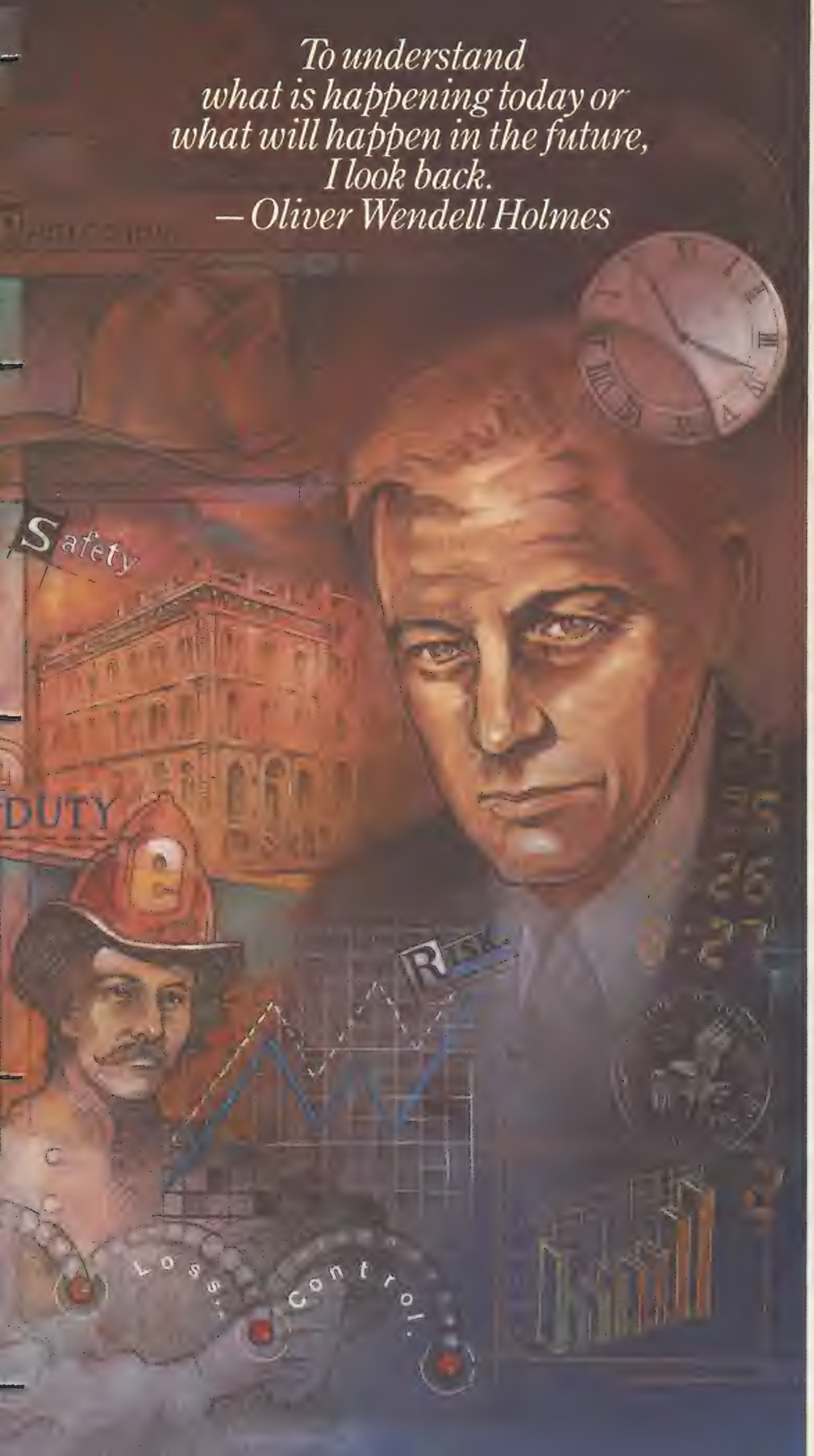
This week the four- or five-mile ride is along rural roads south of Lafayette—a startling procession of prancing, rearing horses: pintos, albinos, Shetland ponies, palominos and bays, their riders dressed in cowboy boots and hats, and even chaps and spurs. Laughing mothers and children sit atop bales of hay in covered wagons. In the cow patch, women ready steaming containers of sausage, chicken and pork for sandwiches. The arriving horses are brushed and allowed to cool down before going back into their pick-up-drawn trailers. The riders, alternating French and English, drink beer or cheap rosé wine and soon dancing starts on the dusty ground.

In an effort to make the music in Cajun country more appealing to the younger crowd, a "new wave" is sweeping over it, producing "progressive Cajun" and "progressive zydeco." This disturbs some of the old-timers and purists, who feel it represents a corruption of the style's uniqueness and continuity. "Now the music is so advanced you can't call it country anymore," says D. L. Menard. Accordionist and accordion maker Marc Savoy, one of the strongest of the traditionalists though only 47, regrets that the "new type is more popular than the genuine version."

Modifying for the new generation

But Buckwheat Zydeco sees it differently. "The older generation wants to stick to the roots, but you can't do that and capture the new generation," he maintains. "You have to modify. I'm willing to give 50 percent to the younger generation, if they give me 50 percent. Sometimes when they see the accordion, they run. They think an accordion is only for polkas. So I give them a little of what they want to hear. After they check it out, they find out they love it."

The same spirit drives the Cajun band Beausoleil, and has made it so popular that it's sometimes difficult for the members to get back for their Thursday gig at Mulate's. Beausoleil can play 18th-century ballads, but it can also turn out a record entitled *Bayou Boogie*. It stirs up zydeco blues, jazz, rock and Caribbean rhythms with Cajun to produce what bandleader Michael Doucet calls a "highly seasoned jumbo gumbo."



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Two-year-old Louis, son of Cajun folklorist Barry Ancelet, latches on to a traditional Cajun accordion.

Doucet doesn't think this is disloyal to Cajun traditions. "We play the gamut, the whole history of Louisiana music," he says, which he points out has many influences—French, Spanish, American Indian, German, English, African, Caribbean, country-and-western, black, and white. In a Beausoleil performance, a conga drummer switches to a washboard; an accordion player to a saxophone.

A fiddler, Doucet, 36, is an example of the recent awakening of interest among the young and educated in a culture once dismissed as "hick." A graduate of Louisiana State University, son of an Air Force colonel, and a recognized authority on Cajun music, Doucet started fiddling in the Cajun style when he was 18, "because no one else was doing it." When he went to France in 1974 as part of a duo called the Bayou Drifters, he realized "there was a whole language and people out there who could understand our songs." The experience changed his life.

Recent fallout from the cultural explosion includes Rockin' Sidney's Grammy-award-winning "Don't Mess With My Tout-Tout"; Emmy Lou Harris' "Lacassine Special," composed by Iry LeJeune; and a performance by zydeco favorites Rockin' Dopsie and the Twisters on Paul Simon's *Graceland* album.

Mike Hébert, manager of the Cajun band Filé, has watched with wonderment the rise in Cajun and zydeco popularity. He notes that the musicians cannot make a living from their music unless they travel most of the year, and when they travel, their music risks losing its fragile, native flavor. "It's the same with Cajun food," says Hébert. "The food and music can get watered down and then lose their appeal."

It's possible, of course, that the music and food will wind up as just a bit of spice in the great American pot. But Hébert may underestimate the resilience of the folkways that have produced them. Given the renewed interest in its heritage and the surge of musical creativity, the culture may now be in a favorable position to retain its own identity, as it has through centuries of adversity, isolation and persecution.

Louisiana folklorist Barry Jean Ancelet has pointed to the "uncanny adaptability" of the South Louisiana culture: "Cajuns and Creoles have always been able to chew up change, swallow the palatable parts and spit out the rest." Next to the exhortation to let the good times roll, the most popular adage in Cajun country is "*Lâche pas la patate*" (Don't drop the potato). What that translates into in South Louisiana is "Hang in there, don't let it go."

Zydeco king Clifton Chenier never really left his Louisiana roots. "It's all right here," he once said.

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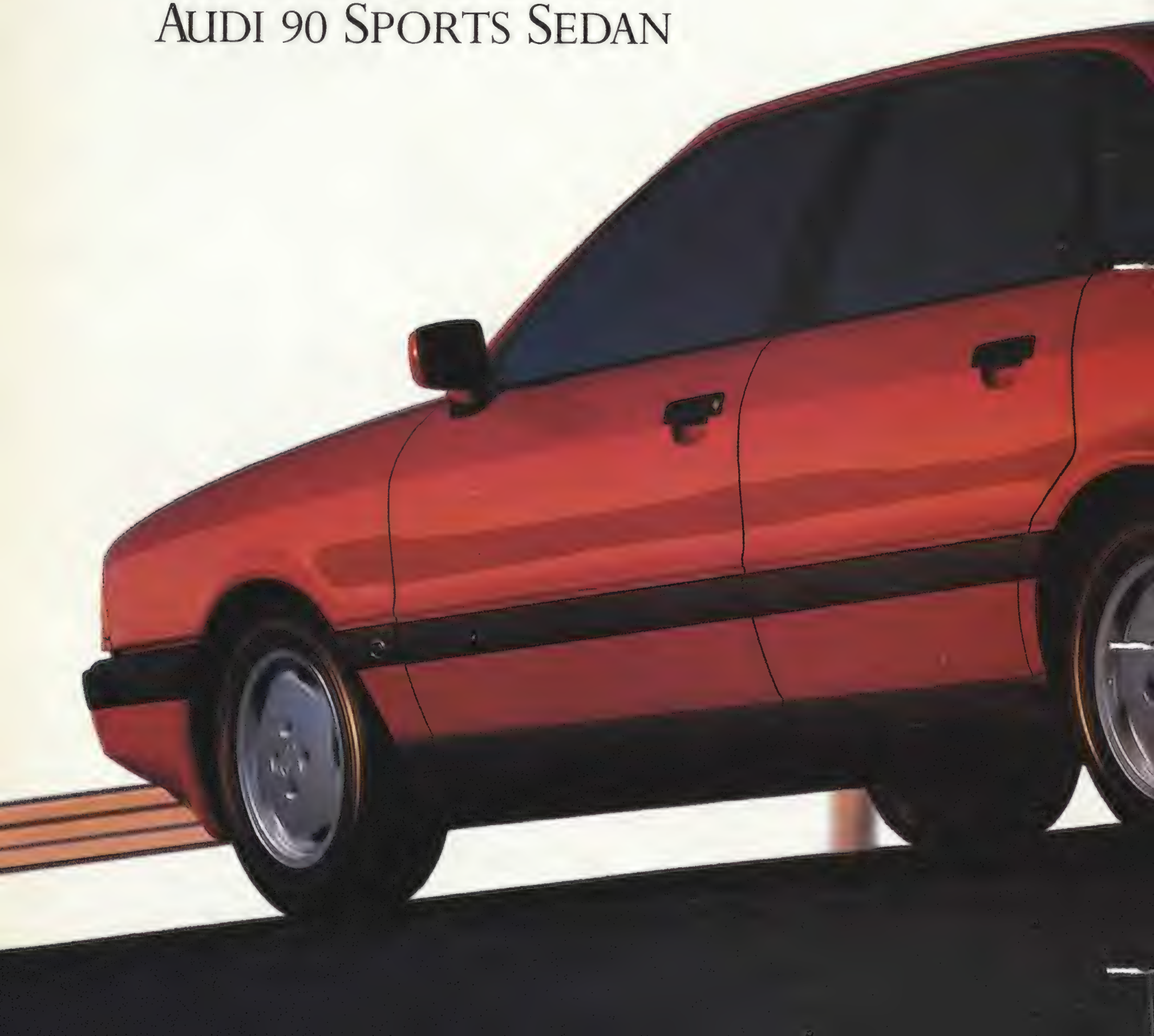

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By William S. Kowinski

There's still time to hop a trolley–vintage or modern

The light rail renaissance is running at full tilt, as people discover that even new high-tech cars elicit nostalgic feelings

It is Easter Sunday on the trolley to Mexico. Little girls squirm in their frilliest dresses, giggling and gossiping as their parents watch San Diego's neat city streets turn into sun-bleached stucco housing developments, industrial parks and shopping centers, truck farms and shipyards, and motels surrounded by palm trees. Finally, the bluffs near the border appear, and the immigration officer stands beside his pale green truck and peers down from the high scrub.

People have been getting on and off the shiny red trolley cars all along the 15.9-mile route–Mexican women with shopping baskets they will fill with groceries in Tijuana; a black woman on her way to visit family, holding her Easter bonnet; students with Walkmans; sailors in flowered shirts.

The three linked cars click quietly along, then come to a stop. After Barrio Logan, National City and Chula Vista, the crowded trolley empties in San Ysidro, across the street from McDonald's, a mile's walk to the shops and stalls that sell blankets, baskets, leather goods and Mexican cocoa along Avenida Revolución in Tijuana. It is the busiest border crossing

A brand-new light rail vehicle—today's trolley—is ready to roll out on newly laid rails in San Jose.

In Washington, D.C. during the trolley's heyday, straw-hatted schoolchildren set out for a class picnic.

in the nation. There is a certain timelessness about this scene, and the trolley fits right in. But in fact this is only the sixth Easter that the trolley has been running in San Diego. The city had one of the first electric streetcar systems on the West Coast, built in 1887. But within 62 years, it had been completely dismantled.

So it was in most cities and towns in America. By the start of the 20th century, more than 30,000 trolley cars were using some 15,000 miles of track (a trolley, or electric streetcar, runs on tracks and uses a pole to draw power, usually from an overhead wire). By 1917, streetcars were carrying more than 11 billion passengers a year along nearly 45,000 miles of trolley tracks. A few decades later, these streetcars were virtually all abandoned, with most of the remaining ones almost invisibly integrated into big mass-transit systems. A notable survivor was a single line of the St. Charles street railway in New Orleans—and even it was without Desire. That famous stop in the French Quarter had been served by another line, which was defunct.

Then in 1981 San Diego made history: it became the first U.S. city in this half of the 20th century to build a major new trolley line. Many forms of public transportation have succeeded one another in American cities, but never before had one been resurrected from the past.

Although holidays are busy periods, the San Diego trolley attracts everyday commuters, too—its ridership has generally increased every month since it opened and the fares pay for almost 90 percent of its operation. There is a second line open now, another scheduled to start by 1989 and several more planned. But San Diego is no longer alone. Within the past two years Portland, Oregon (September 1986), and Sacramento, California (March 1987), opened their first lines. Buffalo, New York, opened one in 1984, and two ambitious projects—in Los Angeles and the Silicon Valley of California—are under construction. Houston, Dallas, Minneapolis and St. Louis are among the cities planning new systems, while at least 20 other cities are studying the idea. And old surviving systems, such as those in Boston, San Francisco and Pittsburgh, are being updated or expanded.

This turn of events has come about with a twist of

San Jose restorer Fred Bennett works on specs for car No. 129 (background), which started its run in 1913.

Polished mahogany, gold leaf and brass of No. 124 are a nostalgic feast for some, a discovery for others.

irony, for the light rail renaissance is predicated at least in part on the congested city's need for urban-transportation alternatives to the automobile—the very vehicle that was largely responsible for killing off the trolley in the first place.

Of course, building a light rail system is expensive, and the system is inflexible because once the rails have been laid, the route can't easily be changed. But their proponents like light rail systems because they can be financed and built faster and more cheaply than rapid-transit subways (like BART in San Francisco and Metro in Washington). Since the basic technology has almost a century's worth of all-weather testing and is simple to begin with, the mechanical risk is modest. And the trolley has something else going for it—a kind of attraction that's hard to pin down.

Bringing back those old sounds and feelings

These are not the streetcars of old; they are technologically modern components of sophisticated transit systems, more likely to be called LRTs (for light rail transit vehicles) than trolleys. But even if today's streetcars are longer and more businesslike than their predecessors—often looking more like a cross between a bus and a jumbo jet—they bring back some of the sounds and feelings of the years when trolleys ran almost everywhere.

In the San Jose Historical Museum's Trolley Barn in Santa Clara County, Clyde Arbuckle sits surrounded by historic streetcars that are in the process of being restored. This spring, these trolleys, some from as far away as Milan, Italy, but others that once saw service in San Jose, will roll along two miles of the San Jose transit mall, which will link downtown businesses, theaters and galleries with a new hotel and convention center and the Great America theme park. Here and in several other cities, getting restored streetcars back on the rails is a byproduct of the light rail revival.

But just as these streetcars embody trolley history, so does Arbuckle, a lifelong resident and historian of Santa Clara County. Although he remembers being shaken awake by the great earthquake of 1906, he isn't quite old enough to have taken a ride on the first electric trolley car in San Jose on the day it first ran in 1890. But he had a cousin, May Gilette, who did, and she told him about it.

Arbuckle's ancestors had arrived in California in 1846, five years after the first group of Eastern settlers crossed the Sierra Nevada. So it was only fitting that Gilette should be part of San Jose's trolley history, although for her it unfortunately turned out to be memorable for another reason. Her ride that evening proceeded uneventfully until, as she described it to Arbuckle, "all of a sudden there was a funny noise,

and a big shower of orange sparks seemed to fly out of a blue core, and the car just stopped." Gilette, wearing her white ribbon signifying membership in the Woman's Christian Temperance Union, had to get out with the rest of the passengers and walk. "And there we were—right in front of that old Fredericksburg brewery!" she told her cousin. "I was never so mortified!"

Arbuckle remembers the glory days of the trolley; in 1918, for example, it stretched from San Jose and Los Gatos to Palo Alto, covering a distance of nearly a hundred miles (actually 98.7022 miles, he recalls). As a boy, he would ride the trolley on rainy days, reading books about the Roman empire or Daniel Boone, and memorizing poems. In later years, the streetcars took him to see the young woman he was courting and soon would marry.

In those days, the trolleys transported workers to machine shops, retail stores and Santa Clara's sprawling lumber mill, the biggest on the Pacific Coast. Today, a new trolley system is being constructed to take workers from the south of what is now known as Silicon Valley to the computer plants in the north.

A new system is needed because the Silicon Valley is beset by some of the worst rush-hour traffic in the country, and smog clings to the surrounding mountains. The system must be built anew because, even in the trolley's finest hour, abandonment of streetcar routes had begun—in San Jose, Arbuckle asserts, as early as 1918. Regular service to the west side of the valley ceased in 1933; and on April 10, 1938, the last streetcar ran in San Jose. So it was all over America: with amazing speed and thoroughness, most of them disappeared as quickly and completely as they had saturated the landscape years earlier.

It started with a kind of stagecoach

The 19th century was the age of invention, grand and mundane, from electric light and the telephone to steam heat systems and the flush toilet. All of them conspired with a growing population and falling farm-product prices to urbanize America. The railroad and telegraph spanned great distances; the next step was to provide analogously modern links to cover the everyday distances within cities and towns.

The horse-drawn omnibus—a kind of stagecoach—became the first form of urban mass transit. Then came the horsecar, which provided a smooth ride on iron tracks, and the cable car, which climbed evenly up the steepest hills by means of a continuously moving underground cable, a sort of steel conveyor belt. (Although San Francisco was the first city to adopt cable cars and is the last to have some in regular service, it was hardly alone. In the 1890s, such cities as New York, Washington, Denver, St. Louis and Seattle

Returning from the border after shopping in Tijuana, a family debarks in San Diego with their purchases.

During the test run of a new car, operator Linda Gartner throws switch on San Jose maintenance line.

Early contenders to replace horse-drawn wagon in cities included Mathewson's rail-riding steam horse.

San Diego's first electric streetcar was photographed at the intersection of University and Normal in 1887.

all had major cable car systems—and the largest of all was in Chicago. Other cities such as Los Angeles, Duluth and Cincinnati had a variation called the "incline railroad" for climbing breathtakingly sheer hills. Two of these still run in Pittsburgh.)

Horsecar and cable car systems were too slow and too limiting. In this age of furious invention, the search was on for the best source of power. An amazing array of gadgetry got serious consideration, including trolleys powered by compressed air in Cincinnati, by ammonia gas in New Orleans, by naphtha (a petroleum derivative) in Brooklyn and by a complex of 80 giant clock springs in Philadelphia.

The winner was electricity. Thomas Edison tinkered for awhile with an electric locomotive, but the task of designing a practical electric railway was left to other entrepreneurs. In 1885, Leo Daft built one of the nation's first regularly scheduled electric railways over three miles of track in Baltimore and later installed "Daft system" lines in several cities (including San Diego). But electrical problems caused sudden shutdowns and occasional shocking experiences for conductors and animals walking on the tracks, leading some to conclude that the electric railroad idea was itself daft.

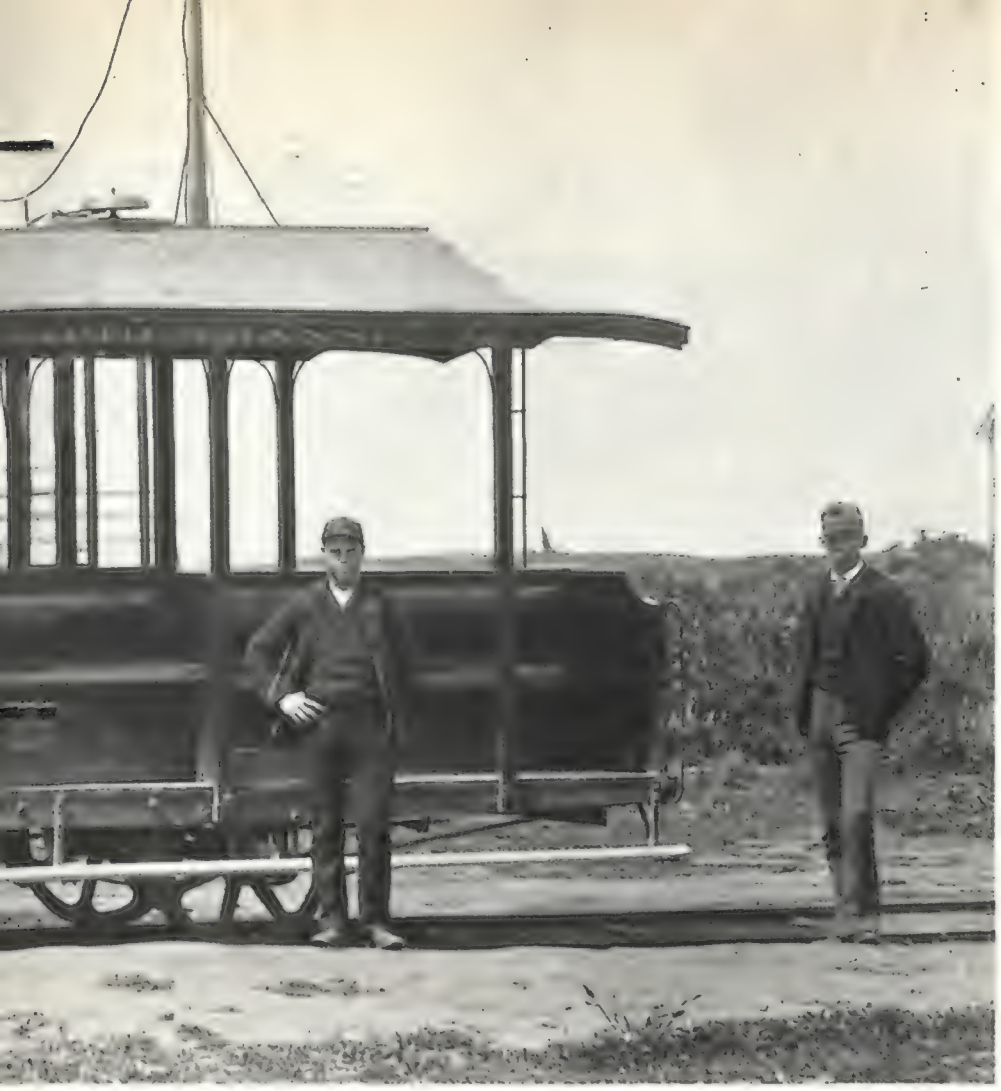
Frank Sprague, an inventor with a mathematics background, designed a more serviceable system. In 1887, the city of Richmond, Virginia, signed on for it. Boston followed, and by 1890 two hundred electric railways had been built in the United States (and several more in Europe), more than 90 percent of them using Sprague patents.

There were local lines in cities and in hundreds of small towns, which then fanned out into rural areas. There were also the "interurbans," larger trolleys for longer distances, which were particularly evident across the Middle Atlantic and Midwestern states, and in Southern California. Even though streetcars were controlled by scores of local and regional companies, they formed a fantastic network. Except for a couple of 20-mile stretches in New York State, it was possible by 1913 to travel from Waterville, Maine, to Sheboygan, Wisconsin—more than 1,000 miles—by streetcar.

The trolleys transformed American space, while fitting perfectly into the social milieu of their times. In the early 1900s, writes E. L. Doctorow in *Ragtime*, "the population customarily gathered in great numbers either out of doors for parades, public concerts, fish fries, political picnics, social outings or indoors in meeting halls, vaudeville theaters, operas, ballrooms. There seemed to be no entertainment that did not involve great swarms of people. Trains and steamers and trolleys moved them from one place to another. That was the style, that was the way people lived."

In Brooklyn so many people went to baseball games by trolley that the local team was nicknamed the Trolley Dodgers, and then simply the Brooklyn Dodg-

Free-lance writer William S. Kowinski, author of The Malling of America, *wrote about shopping malls in the December 1986 issue of* SMITHSONIAN.



But since 1949, when the rails were abandoned, there has been no trolley service to this neighborhood.

Fashions of the early 1900s: garnering admiring gazes, woman in a hobble skirt climbs aboard trolley.

ers. Trolley companies themselves encouraged the trend by building amusement parks and beach facilities at the far reaches of their lines—Wonderland Park at Boston's Revere Beach; Jantzen Beach at Portland, Oregon; Kennywood Park near Pittsburgh; Chevy Chase Lake and Luna Park in Washington, D.C., and another Luna Park outside San Jose.

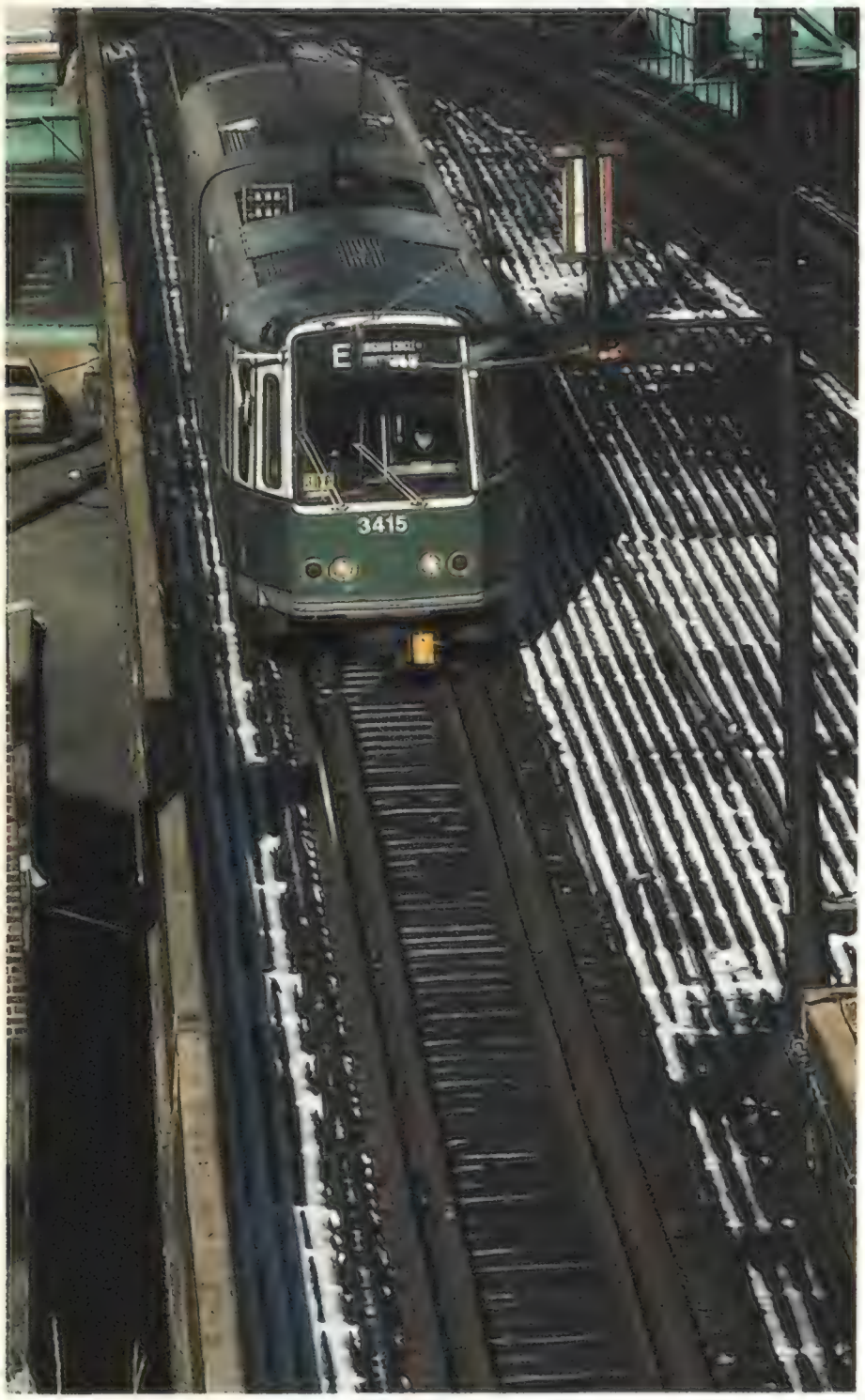
Some interurban lines featured elaborate parlor cars; on a special "party car" on the Harmony Line in western Pennsylvania, riders could even watch movies. But the trolleys also provided services. Besides transporting workers to their jobs, they also brought farm produce to market (including milk on early morning "milk runs") and carried such freight as machine parts, fresh flowers, ice cream packed in dry ice, the U.S. mail and the Sunday newspaper.

Inevitably, electric railways were scenes of events that became legendary, such as the Jesse James-style holdup of a San Francisco interurban by desperadoes on horseback (appropriately apprehended on the Barbary Coast) and the daring rescue of a 2-year-old girl by an Ohio motorman who hung off the fender of his speeding trolley to scoop her up from the rails. At the same time, trolleys were playing a role in how cities expanded, as urban historian Sam Bass Warner jr. has demonstrated in his studies of Boston and Philadelphia. Trolley lines could be extended to sparsely settled areas, with the confidence that their very presence would cause "streetcar suburbs" to spring up. In Southern California, real estate speculators (most prominently Henry Huntington, president of the Pacific Electric Railway) made fortunes by buying up land where the trolley lines would go next. The Los Angeles regional sprawl that many people associate with freeways was actually begun by what was once the most extensive streetcar network in the world.

Trolleys were not problem-free. In the early days, there were frequent accidents, sometimes involving injuries and deaths (President Theodore Roosevelt was jolted out of a horse-drawn carriage when it collided with a streetcar in Pittsfield, Massachusetts, resulting in the death of a Secret Service agent). Congestion in big cities became a problem—Bostonians used to joke wryly that it was faster to walk across the tops of the massed streetcars than to take one to get home. There were also sometimes-violent streetcar strikes, which were chronicled by such novelists as William Dean Howells in *A Hazard of New Fortunes* and Theodore Dreiser in *Sister Carrie*. The trolley industry was vast, employing nearly 300,000 people in 1917.

From the beginning, trolley companies started up, consolidated and went broke with dizzying speed. But after World War I—with the increasing popularity of the automobile—the streetcar started disappearing from towns and cities altogether, especially during the 1930s. Many trolley systems were bought and dismantled by National City Lines. This company, backed by General Motors, Firestone Tire & Rubber, Standard Oil of California and other entities with an apparent vested interest in buses and automobiles, bought up and closed down trolley lines all over the

Pittsburgh's promotional Jolly Trolley takes last run on streets before system went underground in 1985.



Trolley trundles across a viaduct in Boston; next year marks the 100th anniversary of the city's first route.

United States, including San Jose's and the downtown lines in Los Angeles. Some systems made it through World War II, but by the 1960s trolleys were virtually extinct.

It is perhaps the thoroughness with which trolleys disappeared that makes them stand out so powerfully in the national memory. The earliest ones are remembered now for the almost antic individuality of the cars and the identity they gave to cities and towns. "Every city's streetcars were different," says George Sanborn, reference librarian of the Massachusetts State Transportation Library. "When the streetcars went away, so did the flavor of that city."

Today's light rail renaissance began in the mid-1970s. James Mills, California state senator from San Diego, got a bill passed that for the first time allocated money for new public transit from the state highway fund. Light rail wasn't mentioned but the restrictions in the legislation were such that only trolleys fit the bill. San Diego used those funds to finance its trolleys, which in turn inspired other U.S. cities to get started (Canada had actually struck first, with a new system in Edmonton, Alberta, in 1978) and Mills had suddenly become the godfather of the light rail revival. At the time he proposed it, Mills now says, "if you'd asked around, they'd have said I was kind of a rail nut." But he talks much about cost efficiency, about the necessary mix of transit modes and about the quality of service, which gets people who won't take buses out of their autos and into the streetcars.

In fact there are plenty of unsentimental reasons for light rail systems now and into the 21st century. In

the Los Angeles area, which once had more than a thousand miles of trolley tracks in use and now has none, planners are looking at several facts and projections. By the year 2010, one of every 15 people living in the United States will live in the Los Angeles area. The population there is expected to increase by two million. There are about six million registered motor vehicles there now. The average speed on L.A. County's vast freeway system is 33 miles per hour, and by the year 2000 it is expected to drop to 15 mph.

"Eyes have been opened," says Ann Reeves, of the Los Angeles County Transportation Commission's communications department. "Before 1987, we could have danced on our hands to get anybody's attention. But transportation is today's big story."

William F. Hoey, a transportation planner for 25 years, is a light rail advocate. During that time, he has heard plenty of proposals for high-tech, big-ticket solutions, including monorails, gravity vacuum tubes, tracked air-cushion vehicles and people movers. Until recently, transportation professionals seemed to have forgotten about a system that was proven. "I think we recognize that light rail transit is not *the* answer to all urban transportation problems," he said at a national planning conference, "but it has proved to be highly cost-effective in carrying people to, from and within high-density areas, and it can facilitate and reinforce land-use planning decisions about medium- to high-density development."

Today, earth is being moved, pylons sunk, bridges built and railroad tracks laid for two Los Angeles light rail projects under construction. The Century line—a "multimodal system"—is perhaps the more dramatic example of the new transit philosophy of mixed systems. It is being built simultaneously with a new freeway—bisecting the freeway's three-lane components—and it will feature park-and-ride and feeder bus service to trolley parking lots, as well as rapid-transit, ride-share and regular freeway lanes. The other project is the Long Beach line, which will stretch from downtown Los Angeles through more than 20 miles of neighborhoods and past many factories and businesses.

Hoey believes that the loss in 1961 of the efficient trolley service between the predominantly black and poor Watts area and the service and clerical jobs in downtown Los Angeles "appears to have played a part in the devastating riots of 1965." (His conclusion is supported by the McCone Commission, which studied the riots.) The new Long Beach line will serve Watts again, near where it and the Century freeway lines meet—and the trolleys will pass within view of the now-famous Watts Towers.

There are a number of trolley museums in the United States and Canada and their preservation and restoration efforts over the years have made it possible for an increasing number of cities to put what most people know as streetcars back on the rails, at least once in a while. The expertise gained in that restora-

Built in the early 1920s, New Orleans streetcar No. 962 rumbles along the St. Charles line in 1982. In its early years, this trolley used to pass its sister car, named Desire, along busy Canal Street.

Here, six trolleys from San Francisco fair; above, one of city's restorations.

Boat tram built in 1934 served vacationers in Blackpool, England.

San Francisco's oldest car, which cost $7,700, dates from 1912.

Soviet Union donated car that once carried passengers in Moscow.

Car built in 1951 for Hamburg, West Germany, has a public-address system.

Car No. 1834 plied the rails in Milan, Italy, from 1928 until 1984.

tion is equally important. Karl Johnson, who learned his skills as a volunteer at the Seashore Trolley Museum in Kennebunkport, Maine, gets the cars in shape for San Francisco's Trolley Festival. Each summer, it features vintage trolleys from all over the world—the Red Baron from Hamburg, the Melbourne Marathoner and the city's own Wonderful One, the first publicly owned streetcar in America. Fred Bennett, who directs the San Jose restorations, came from the Shoreline Trolley Museum in Connecticut.

In the rolling hills of western Pennsylvania, amid horse farms and industrial parks, the Arden Trolley Museum is open for business. On the first day of the season—May through October—a dozen or so patrons are taking a ride on an old trolley car. Among the vintage cars they see on the premises are a Philadelphia Suburban with half-moon, green stained-glass windows and rattan-covered seats, and a streetcar named Desire—the very New Orleans car that *Life* photographed when the Tennessee Williams movie first opened in 1951.

Earlier on this spring day, Arden sent one of its cars to Pittsburgh to run on the city's new South Hills trolley line on its opening day. Pittsburgh has rebuilt almost half of its light rail system, perhaps the oldest in America. (Philadelphia also has 19th-century lines that have remained in continuous operation. Toronto's street railway, part of what experts regard as the

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When the trolley lines shut down, the streetcars that weren't destroyed were often sold cheaply and put to a variety of uses, as homes (particularly during the Depression), restaurants and storage facilities (one museum acquired a car that had housed farm animals, but couldn't quite get enough of the smell out of it to make it usable). "We were fortunate in the West," says Harre Demoro, San Francisco journalist and board chairman of the Bay Area Electric Railroad Association. "Our systems lasted longer and our weather did less damage to the cars than in the East. So our Western Railway Museum and the Orange Empire Railway Museum in Southern California got cars that were in much better shape." Volunteers at Arden would agree. Restoring some of the cars they have acquired will keep them busy well into the 21st century.

The dedication of trolley enthusiasts seems to express the feelings that many people have about trolleys. Why are streetcars so fascinating? In the San Jose Trolley Barn, Fred Bennett, who has been restoring streetcars since 1941 and who has made many trips around the country to ride every trolley he could find, explains it: "There are patterns, movement, art," he says. "They're machines that have life to them."

In their heyday, they were machines that generated affection, combining power and modesty. They were real trains but without the noise and smoke; they went over high bridges and quietly down tree-lined streets, across wide distances, into bustling downtowns—yet for all their modern power and great range, you could catch them on your own street corner.

The future of the trolley may be determined by whether such affluent areas as the San Fernando Valley in California will accept them, or whether they will extend to the new, satellite "urban villages" such as Tysons Corner, Virginia, outside of Washington, D.C., as San Diego writer Richard Louv thinks they should. But it may also depend on certain memories, of that swaying and quiet clicking, the arrival heralded by a familiar bell. Before there was the light rail car, there was only the streetcar.

Dapper trolleymen Richard Morley (left) and Ray Fontaine synchronize their watches before starting runs in San Francisco. Car at left is one of two from Melbourne, Australia, in the city's historic fleet.

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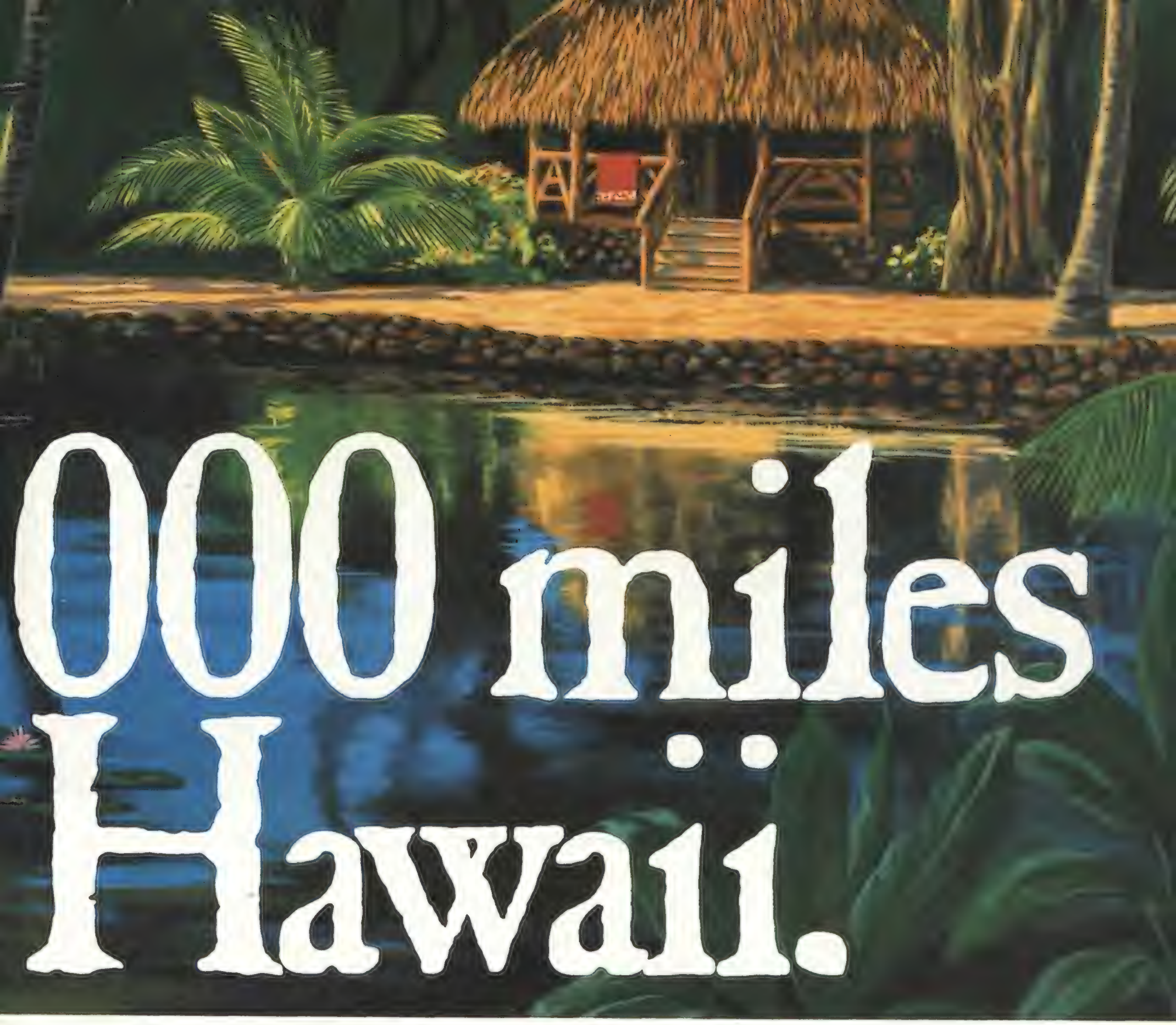

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Pilot Doyle Krumrey brings the ER-2 in for landing after an arduous and hazardous flight over Antarctica.

NASA aircraft is packed with complex scientific instruments for sampling compounds in "ozone hole."

By Ellen Ruppel Shell

Solo flights into the ozone hole reveal its causes

A NASA expedition sends experiment-packed plane ten miles up into the stratosphere to find what is destroying Earth's protective shield

The first thing I notice on our final approach into Punta Arenas airport is the rainbow. It forms a bridge between the mudflats and the Strait of Magellan. It makes me hopeful that the warnings I've been given about the dismal climate here, the southernmost city on Earth, have been exaggerated. But the rainbow is the last bit of natural color I will see for some time. Even the penguins have left in search of more hospitable shores. Few visitors come to Punta Arenas in late August, austral winter, when droning rains can turn the gloomy streets into aquatic parking lots, and winds sometimes flatten the forests.

All this makes the clumps of English-speaking scientists and technicians even more conspicuous. There are roughly 150 of them and they are everywhere—bundled in rain jackets, checked-flannel shirts and parkas. Tightly clustered, collegial, secretive, they gather before a meeting in the lobby of the city's one luxury hotel. They are edgy and excited, short-tempered and ecstatic. They are, they know, a sort of scientific SWAT team, handpicked from among the best in the world. Some of the younger and less experienced

Mission is to determine if widening hole is natural or if it is caused by chemicals manufactured on Earth.

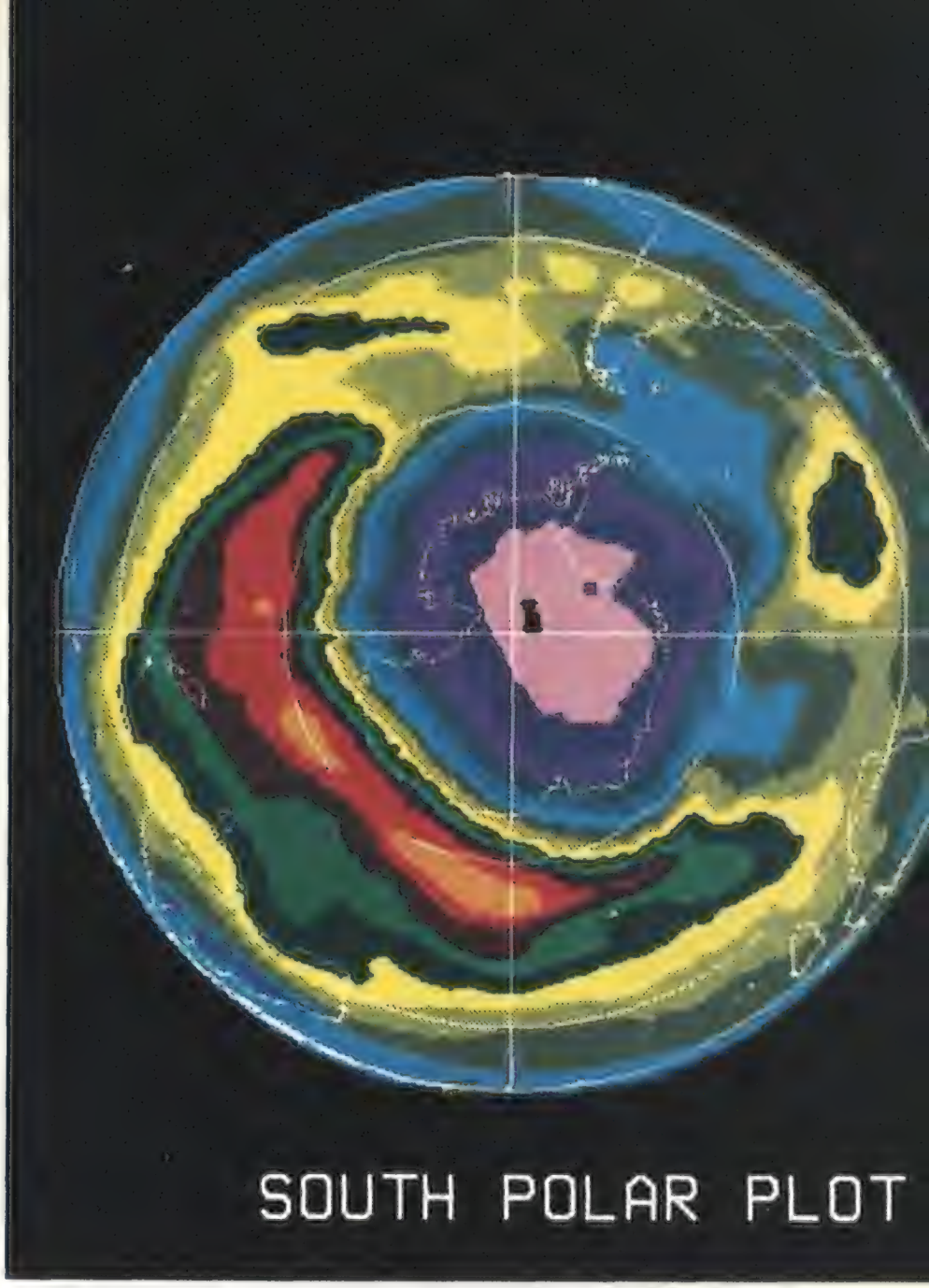

Image recorded by Nimbus-7 satellite over the area shows ozone hole (center) at peak last year, October 15.

among them cannot help but swagger under the glow of this distinction. But most are sobered by the weight of their assignment. They have eight short weeks to get to the bottom of one of the most startling scientific mysteries of the decade, eight weeks to find out why the stratosphere above Antarctica loses nearly half of its ozone every year.

The stratospheric ozone layer is often called a shield, but this metaphor is misleading. It is more a gossamer canopy, a sparse scattering of molecules accounting for no more than three parts per million of atmosphere, tiny specks floating in a boundless sea. And what little ozone there is, is extremely fragile. The bonds holding the three oxygen atoms that make up the ozone molecule are easily parted by any number of reactions. This is of no concern in the lower atmosphere, where ozone is a nuisance, a particularly noxious constituent of smog that we would do far better without. But cast into the stratosphere, that vaguely construed slab of air that is roughly 10 to 30 miles above the Earth's surface, ozone is precious stuff. It is the Earth's only defense against the effects of potentially harmful ultraviolet radiation from the sun.

Certain wavelengths of ultraviolet radiation (UV) that are called UV-B can wreak havoc with all things organic. UV-B is known, for example, to cause skin cancer and to disrupt the life cycle of plants. Unchecked, it would make life on Earth impossible. But stratospheric ozone intercepts most of the life-threatening UV in a reaction that results in its own breakdown into molecular and atomic oxygen. These bits of oxygen are quickly united to create new ozone molecules. Left alone, nature keeps the creation and destruction of ozone in careful balance. But it has been years since nature has held sole rein over this process.

Man-made chemicals emitted freely into the atmosphere have disrupted the equilibrium. Some fear that the ozone hole above the South Pole is a consequence of this hapless process, the first physical sign that we are systematically destroying the very substance that made life as we know it possible in the first place.

Until three years ago, there was no reported evidence that the ozone was thinning, let alone that a seasonal balding patch the size of the continental United

Photographs by Ian Yeomans

One of five pilots who can fly plane, Ron Williams doffs helmet after taking the ER-2 into ozone hole.

States had developed. The hole was stumbled upon by an obscure team of scientists from the British Antarctic Survey. The leader of that team, Joseph Farman, is an ironic, self-deprecating man who has quietly monitored ozone levels since 1957. His instruments are based at Halley Bay, a lonely outpost on the Antarctic coast. Farman had noticed a decline in ozone levels every September and October since 1977, but he hesitated to report his findings. After all, no computer model had predicted the decline, nor, apparently, had it been spotted by the Nimbus-7 satellite. Launched in 1978 by the National Aeronautics and Space Administration (NASA), Nimbus-7 carries, among other instruments, a Total Ozone Mapping Spectrometer specifically designed to monitor ozone levels. Farman is a careful man, not given to premature outbursts, and he was puzzled by NASA's failure to report the hole. By late 1984, however, he decided that he had no choice but to go public with his findings. His paper, published in May 1985 in the British journal *Nature*, set the world's insular and circumspect atmospheric-science community on its ear.

NASA scientists scrambled to find an explanation. A careful combing of past reports revealed that the satellite had indeed picked up the hole, but that computers receiving data back at NASA had set aside the finding as an aberration. No one had anticipated that ozone could reach such low levels in the Antarctic stratosphere. It was clear, as one scientist put it, that Farman's finding was the monitoring scoop of the century. But how to explain it? Although several promising theories emerged, none was considered definitive. The truth was that no one knew enough about the chemistry of the Antarctic stratosphere to come to any informed conclusion.

A chunk of atmosphere like no other

The stratosphere above the South Pole is like no other chunk of air in the atmosphere. For one thing, it is dominated by the coming and going of the polar vortex, a tightly twisted whirlpool of winds. When this vortex breaks up in November, the region is replenished with air from other parts of the stratosphere. This explains why the ozone hole disappears every spring—ozone-rich air rushes in and fills the gap. The Antarctic stratosphere is also extremely cold, so cold that it causes nitric acid to freeze into crystals that gather into wispy, pink clouds. These polar stratospheric clouds, which are rare beyond the Antarctic, were thought to play a crucial role in the breakdown of ozone. But again, this was only a theory; there were no data to back it. In August 1986, a hastily assembled team of scientists was sent to Antarctica to see if they could get some.

Right after ER-2 landing, two members of James Anderson's team wheel a pod carrying his experiment to hangar where raw data can be fed into computer to measure compound considered a prime suspect.

The scientists of the National Ozone Expedition worked with as much precision as time and weather conditions would allow. They used carefully calibrated instruments called spectrometers to monitor the gases of the stratosphere from the ground, and launched other experiments directly into the hole in enormous helium balloons. After more than two months of 18-hour days spent studying the Antarctic stratosphere, they found the chemistry to be, as one of them put it, "highly perturbed." But their work, while excellent, was inconclusive. The cause of the ozone hole remained a mystery.

And so, on to the campaign in Punta Arenas, called the Airborne Antarctic Ozone Experiment. Everyone in this thriving port city of 90,000, it seems, is delighted to play host to the scientists, who bring a welcome diversion from the rainy months—as well as a large infusion of much-needed money.

"Everyone is waiting for news about the hole," says Fernando Calentta, a 37-year-old documentary film producer. He was born and has lived his entire life in Punta Arenas. "We are worried that, if the hole gets much worse, we will not be able to go out during the day. The irony is that we have very little sunlight here—to not be able to enjoy the few sunny days we have would be tragic."

Other Punta Arenans—secretaries, waiters and shopkeepers—echo Calentta's concerns. The weather here has been unusually warm of late and there is not as much snow as there used to be. Could that, the proprietress of a cosmetics shop asks me, be the result of the ozone hole? What about the fish? asks a cab driver. Could the ozone hole be the reason why the catch has been less abundant this year? No one in authority has suggested that it is, but the uncertainty is unsettling. It is said that local property values have declined since the ozone hole's discovery.

Residents of the city are hungry for information from the NASA team, but as of now they are told very little. The mission is conducted in secret to prevent data from leaking prematurely and being misinterpreted by journalists or other outsiders. Every day, the scientists rise early, breakfast in their hotel, then

Ellen Ruppel Shell is a science writer based in Boston and a frequent contributor to SMITHSONIAN.

NOAA investigator Roger Jakoubek sets up device to detect ultraviolet through quartz window on DC-8.

Inside DC-8, scientists and their instruments turn the converted passenger cabin into a flying laboratory.

board a sorry-looking fleet of rental cars and vans for the 15-mile drive to the airport. The experiments are conducted in makeshift laboratories there, behind well-guarded doors. No one is permitted inside without a pass, and no one is issued a pass unless he or she is assigned to the mission. From the first it was decided that this mission would be definitive—nearly every chemical related to the breakdown of ozone in the stratosphere will be monitored. This time, the cause of the ozone hole will be revealed.

As of now, two major theories have emerged to explain the hole. The first is meteorological—it involves the simple movement of air from one place to another. It could be, for instance, that ozone is just pushed out of the stratosphere every September by an influx of ozone-poor air rising from the troposphere, the region of atmosphere closest to the Earth. This natural effect would have no dangerous implications.

The alternative theory is far more troubling. It is that chemicals produced on Earth are catalyzing the breakdown of ozone above the South Pole at a rate so great that it bodes ill for the ozone layer protecting the rest of the planet. The chemicals of most concern are chlorofluorocarbons, better known as CFCs.

CFCs, in one form known as Freon, are incredibly useful substances. They figure in foam insulation, in air conditioners, in fast-food containers and in solvents used for cleaning microchips. The United States, Canada and several Scandinavian countries banned the use of CFCs in aerosol sprays in 1978, but other nations such as England, West Germany and Japan continue to propel everything from deodorant to whipped cream with the chemicals. However, CFCs need not be squirted from a nozzle to be released into the atmosphere: air conditioners and refrigerators leak, foam insulation gets burned and solvents evaporate. Eventually most of the CFCs manufactured on Earth will find their way into the sky.

James E. Lovelock, a British biospheric chemist, was one of the first to measure significant quantities of CFCs in the atmosphere in the early 1970s. Lovelock is perhaps best known as father of the Gaia hypothesis, the concept that the planet Earth is a living organism with a life force of its own. He was not terribly concerned with his finding of CFCs in the atmosphere, for he believed that the Earth was perfectly capable of coping with one more pollutant. And, in a way, he was right. CFCs are the opposites of ozone in the sense

Lab's role is to determine chemical composition of lower air masses and to "look" up into the hole.

that they are remarkably stable compounds. Since they rarely react with other chemicals they are neither toxic nor flammable. Hence the presence of these seemingly benign chemicals in the atmosphere appeared to pose no threat—until scientists started thinking about where the CFCs were going.

Two such scientists were Sherwood Rowland, a chemist at the University of California, Irvine, and Mario Molina, who was then his postdoctoral fellow. Rowland was intrigued by the notion of a compound as stable as CFC being released into the atmosphere in such great quantities. Rowland and Molina quickly determined that 99 percent of the CFCs ever released would end up in the stratosphere. This troubled them. The upper stratosphere above most of the ozone layer is rife with ultraviolet radiation from the sun. Ultraviolet light is one of the few things that can break down CFCs into their constituents of carbon, fluorine and chlorine. Chlorine is a very reactive chemical and ozone is a very vulnerable molecule. It soon became clear that chlorine released from CFCs would attack the ozone layer in a chain reaction that begins with the formation of chlorine monoxide from CFCs and ends with thousands of ozone molecules being turned into oxygen. Oxygen, unlike ozone, does not screen out harmful ultraviolet radiation. Rowland immediately sounded the alarm: if CFC emission is not controlled, he warned, ozone will deplete dramatically by the middle of the 21st century, exposing Earth to untold levels of ultraviolet radiation.

The controversy over Rowland and Molina's theory was fierce. The CFC industry was particularly incensed. It argued that no erosion of ozone had been detected and that Rowland's hypothesis was just that—a theory with no proof. But other scientists corroborated Rowland's conclusions and today there is no disagreement that ozone is being destroyed by chlorine in the stratosphere. The only question is how much and how fast. Rowland and Molina, as well as many other scientists, predict that, given current production levels of CFCs, there will be a significant loss of stratospheric ozone around the globe within the next 50 to 60 years. But not even these alarming predictions anticipated the sharp annual drop in Antarctica. If, in fact, the hole is formed as a result of chlorine liberated from CFCs, it might be that the current calculations overlook some factor that would cause ozone to deplete faster than is currently thought. Such a finding would affect not only a multibillion-dollar chemical industry, but international environmental policy.

That's why the $10 million being spent on the mission in Punta Arenas is considered by many to be a bargain. Put simply, its goal is to sample the air in the Antarctic stratosphere, analyze it, and determine once and for all if either chemicals or wind patterns are to blame for the hole. Collecting and analyzing air samples in the hole, at altitudes of up to 67,000 feet, is not simple. It requires extraordinary skill, extraordinary precision, extraordinary planning—and two airplanes. One, a DC-8, is a passenger plane that was gutted and refurbished to accommodate more than 40 scientists and technicians and seven different experiments.

Flying lab and modified spy plane

The plane is essentially a flying laboratory: it will cruise for as long as 18 hours at up to 40,000 feet over the Antarctic continent taking measurements all the way. The DC-8 uses remote-sensing devices to "look" up into the hole, but it cannot fly into the hole itself. For that, a completely different aircraft is required, a whimsical-looking machine called an ER-2.

There is only one ER-2 in the world and it belongs to NASA. A modified version of the U-2 spy plane, it is often described as a rocket with glider wings. The ER-2 cockpit is compact, big enough to hold a single pilot but little else. Its wings are long and graceful and they flex, birdlike, to absorb the weight of the plane when it lifts from the ground. Just after takeoff,

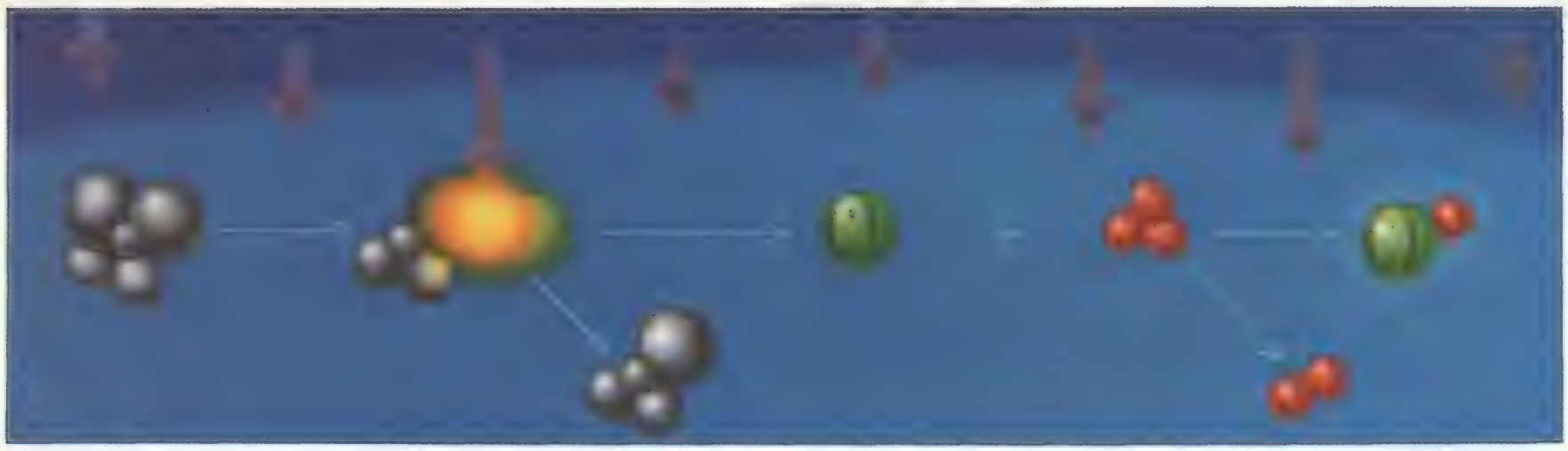

Diagram shows chemical reaction that contributes to ozone hole: CFC molecule (left) is split by UV rays, freeing chlorine, which then splits ozone into oxygen and chlorine monoxide, the "smoking gun."

the plane is a little hard to handle—it's not entirely at home at low altitudes. But above 60,000 feet, the pilots say, it's as smooth as a Cadillac on a Sunday drive. The ER-2 was, after all, designed to fly high specifically to carry experiments into the stratosphere. The plane flies too high to allow scientists to control their experiments from the ground, so the pilot triggers the experiments with simple on-off switches. Twelve miles up, the pilot is in complete charge.

There are only five men who are currently qualified to pilot the ER-2. Four of them are taking turns in Punta Arenas, flying the seven to eight hours from Chile to the heart of the hole and back without a break. All of these pilots are specialists; they fly high and long all the time. But these flights, the first series the ER-2 will make over the South Pole, are clearly not routine. Tomorrow it is Doyle Krumrey's turn to fly, and there is no question that he is nervous. I catch up with him in the lobby of his hotel and we talk about tomorrow's mission.

Krumrey is a Vietnam veteran and former reconnaissance pilot. He is taller and broader than one would expect, given the size of the ER-2 cockpit. He is also gruff and fiercely independent. "We've had the ER-2 for five years and all that time it's flown like a dream," he says, his eyes fixed on the wall, his hands busy with a cigarette. "It's extremely dependable in all environments. However, putting a single-engine airplane into an environment like this is not like riding a bike down a street. The chances of us recovering, if we have to eject from the plane, are very, very slim."

So when Krumrey prepares the next morning for his turn at the controls, the usual preflight air of anticipation has condensed into a low-level tension. His suit, five layers of Nomex and neoprene fastened with airtight zippers and topped, astronaut-style, with a ten-pound helmet, appears as comfortable as a straitjacket. As 10 A.M. approaches, he is driven to the plane, a life-support technician by his side. Slowly, he climbs on board, shakes hands with the technician, puts on his gloves. The technician hooks up an umbilical cord from Krumrey to the plane's oxygen supply. The ER-2 is ready for takeoff.

A group of scientists, bundled against the chilling winds, stand outside the ER-2 hangar to wish the airman a safe trip. The engine starts, the plane taxis down the apron and onto the runway, picks up speed, then seems to pause momentarily, as if to take a deep breath. Then, with a roar of thrust, the ER-2 disappears into the deep-blue Chilean morning. It will be out of sight for the next six and a half hours. During that time, Krumrey will sit, fixed, in the pilot's seat.

One by one, the scientists filter back into the airplane hangar where the Chilean government has built them a row of simple offices. Because it is on the military side of the airport, the hangar is tightly guarded. A silent soldier with a submachine gun is posted outside. Inside, there is a scattering of human touches: an exercise bike, a pile of cots. The overall impression, however, is dreary. Instant coffee is made by pouring bottled water into a Styrofoam cup, sprinkling in some crystals and heating the mess in a microwave oven. Most of the work goes on in the offices at the rear of the hangar—cramped, whitewashed spaces jammed with computers and hung with computer printouts of vast quantities of data. But the scientists don't complain; ambience is the last thing on their minds.

There are more than a score of research teams from the United States and Great Britain in Punta Arenas, and each will make an important contribution to whatever conclusions are drawn from the expedition. But months earlier Robert Watson, the brilliant and outspoken NASA scientist and administrator who masterminded the Punta Arenas project, told me about one of the keys to the success of the mission. It is an experiment that has great potential for determin-

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After ER-2 lands, Anderson connects pod experiment to his computer to copy out data collected in flight.

Melanie Steinkamp, researcher at NOAA Aeronomy Laboratory, gets air sampler from just-landed ER-2.

ing whether chlorine liberated from CFCs is causing the ozone hole, and it is directed by chemist James Anderson, holder of the Philip S. Weld Chair in Atmospheric Chemistry at Harvard.

Soft-spoken, intense and keenly charismatic, Anderson is one of the most highly respected experimentalists in his field. His specialty, making precise measurements of chemicals in the stratosphere, is difficult because the stratosphere is so distant and because the chemicals it contains are so scarce—as scarce, Anderson says, as a drop of vermouth stirred into an Olympic-size pool of gin. He is interested in the most elusive of these elusive substances, a group of oddball molecules and atoms known as free radicals. Like a green branch torn from a tree, free radicals are ripped from a mother molecule, a process that strips them of an electron and leaves them hungry for any substance that will fill the void. Some free radicals, including chlorine, find gentle ozone, with its weakly bonded oxygen atom, to be a particularly tempting target. He measures the rate of this reaction by monitoring the levels of chlorine monoxide, the unstable byproduct of the collision of ozone with the chlorine atom. Where there is chlorine monoxide, there is ozone destruction.

Anderson has detected chlorine monoxide in the stratosphere and this alone is proof that ozone is being destroyed by chlorine. But it is not evidence that chlorine from CFCs is to blame for the formation of the ozone hole. For that, Anderson will have to determine how much chlorine there is in the Antarctic stratosphere and whether the amount is adequate to account for such a rapid breakdown of ozone. He will also have to consider the work of fellow scientists who have come to Punta Arenas to measure levels of other chemicals that could, conceivably, combine with chlorine, rendering it harmless. If levels of these other chemicals are high, then the chlorine radical is probably not to blame for the ozone hole.

Redesigning a critical experiment

Anderson generally launches his chlorine monoxide experiments in gigantic helium balloons, diaphanous hulks five times the size of the Goodyear blimp, that require a launch crew of ten and ideal weather conditions. Antarctica is known to have some of the cruelest weather in the world. It was clear that if Anderson were to participate in the Punta Arenas expedition, his experiments would have to be borne by the ER-2. He had never designed an experiment to work on any airplane, let alone a plane with such strict constraints. NASA administrator Bob Watson gave him five months.

Anderson gathered together his team of scientists, engineers and computer programmers, and set to

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Peter Salter of United Kingdom Meteorological Office is Punta Arenas weatherman for DC-8, ER-2 flights.

work. His experiment detects molecules by using a very delicate and easily perturbed device, and air must flow through it slowly and without touching any surface. This is no problem in a balloon, but a bit difficult in the wing of an airplane flying many hundreds of miles per hour. Anderson called for help from an old college friend, Paul Soderman, an aerodynamicist at NASA's Ames Research Center in Mountain View, California.

Soderman dug through the engineering literature and found a paper written in the 1940s that addressed a similar aerodynamic problem in World War II fighter planes. After many calculations and weeks of experimentation, he designed a duct system that slowed down the air, then captured a small core for analysis.

Anderson's group worked nights and weekends to integrate the new airflow system into their experimental apparatus. They also had to build an entirely new detection system, one that could operate with no human intervention. The pressure was crushing. But Bob Watson still pushed for the deadline. More data from Antarctica, he said, was essential for setting international controls on CFC production, negotiations for which began in earnest soon after the hole was discovered. An international agreement on any environmental issue would be precedent setting, and Watson was loath to break the momentum of this one. There was no doubt in Watson's mind that CFCs will, eventually, erode the global ozone layer and should be limited. But if CFCs were found to be involved in the ozone depletion over Antarctica, then surely their immediate reduction would be more critical. "The question is, is this a natural or a human-induced phenomenon," Watson says. "The smoking gun will be chlorine monoxide. We have to find out how much there is relative to other chlorine species."

Anderson's operation was tight-knit and streamlined. Every piece of equipment, every computer program, even most of the circuit boards in the computers were designed and built by members of his team. Nothing was left to chance and no outsiders were employed for the project. "In this business, subcontracting is death," he says. "Each person who works on the project must be totally dedicated to it; there is absolutely no room for screwups."

And there weren't any. In July, Anderson went to California to test-fly his new machine. It worked perfectly. The mission was go.

But flying off the coast of California in midsummer is nothing compared with flying into the Antarctic vortex. Anderson is not absolutely sure that his rig will work in Punta Arenas. Usually even-tempered and soft-spoken, here he is abrupt, even dismissive. On flight day he gets up at 4 A.M., too early for coffee, and drives himself and his team to the airport. It is dark, no one else is on the road, which skims close enough to the strait to be slightly hazardous. He pulls into a mud lot and everyone heads through the darkness into the hangar. Inside, the stereo comes on almost simultaneously with the lights. Bach, it seems, is to be an honorary member of the Anderson team.

The ER-2 takes off precisely at 10 A.M., and when I finally catch up with Anderson around lunchtime, he is too busy to eat or even talk. He's told me that an earlier flight was not entirely successful; some data were lost due to a freeze-up of part of the detection system. This one, he hopes, will be better. But there is no way to know how things are going until the plane lands at 4 P.M. Meanwhile, all anyone can do is calculate and recalculate probabilities, refine computer programs, fiddle with electronics. Time drags. A technician spends an hour pumping the exercise bike, working up a sweat in the 30-degree gloom. People scuttle back and forth among the cubicles, barely nodding hello.

Scientists applaud as the ER-2 lands

Finally, word comes that the ER-2 is preparing for touchdown. The hangar empties as scientists, engineers and technicians rush to watch the landing. The ER-2 circles, then swoops down, gliding effortlessly onto the runway like a skier skimming over hard-packed snow. It lands on two tiny wheels, then slowly taxis until its wings are cradled by the hands of two technicians. The scientists applaud and respectfully resist the temptation to storm the plane right on the apron. Krumrey, the pilot, takes off his helmet. He smiles, waves, gets out of the plane and lights a ciga-

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rette. In an hour he will meet with the scientists and give them his view of what went on inside the ozone hole. But for now, it's time for a shower and a beer. He has flown farther south in the stratosphere than any man. He is very happy.

The plane is towed into the hangar and instantly swamped by the data-hungry hordes. Some jump for the cockpit, others check instruments at the wingtips. Anderson and his chief engineers, Nate Hazen and Joe Demusz, get screwdrivers and quickly bore into a pod, the metal pouch on the left wing that holds their experiment. The team's two programmers, Maria Mueller and Norton Allen, roll out a small computer, then string a cable from it to the computer inside the experiment. The computer in the wingtip clicks on, then dumps the data it has collected every second for the past six hours into the waiting machine. Everyone's eyes are fixed on the computer screen. In seconds it's finished. Anderson leans over, grabs Demusz and plants a kiss on his cheek. The data record is complete.

The ER-2 makes 12 passes through the Antarctic stratosphere in August and September, and each trip brings new information. The chlorine monoxide level, as measured by Anderson's experiment, rises steadily until, at certain altitudes, it is 500 times normal concentrations. Equally startling, ozone levels drop precipitously. By the middle of September, about half of the ozone normally expected in the region has disappeared. The ozone hole is deeper than ever this year and chlorine is higher than even Anderson anticipated.

The scientists work furiously, meeting constantly to share data and ideas. It is rare that so many minds are put to a single scientific problem, rare that scientists can meet and discuss their work with so many without submitting it to outside scrutiny. The needs of the community are put before the needs of any individual, and sometimes data are released even before they can be analyzed by the scientist who gathered them. There is no time for egos to erupt, no time for competitiveness. This is not the way science generally proceeds and it makes some people nervous. Most, however, are exhilarated.

"We don't want to catch the criminal after the corpus delicti has cooled," Anderson explains. "We have to start with a living, breathing body. That means that every chemical that can be measured must be measured and measured precisely. There isn't a single instrument on either plane that, in the long run, won't be crucial. If there is any ambiguity in our findings, our impact will be weakened. The burden of proof is enormous."

And so is the pressure. The failure of one instrument has immense implications for the operation of others. There are several failures. But none of these turns out to be permanently disabling. As October nears, a chemical snapshot of the Antarctic stratosphere comes into fuzzy focus. Bob Watson, looking tired and out of sorts, travels to Washington, D.C. to announce the mission's findings. James Anderson makes a similar announcement on the same day in Chile's capital, Santiago. The news they have is not entirely good. The edge of the stratospheric ozone hole has crept as far north as the tip of South America, an area that includes Punta Arenas. Fortunately, the sun does not shine brightly in that part of the world in winter and the ozone depletion there is not severe. However, no one can say what will happen if the hole grows deeper or spreads farther, although the latter is unlikely. The ozone hole seems to wax and wane with the Antarctic vortex; any chunk of stratosphere beyond the grasp of this whirlpool of winds is not likely to be affected.

The evidence: CFCs are involved

Thanks to Anderson's measurements, there is no longer a question of whether chlorine monoxide is involved in the formation of the hole; unless current theories are entirely off base, it is. But it is also clear that more than chemistry is involved. At the very least, it is probable that the peculiar meteorology of the Antarctic stratosphere, with its extremely dry air, its polar stratospheric clouds and whirling vortex, contributes to the breakdown of ozone. In fact, there were several large-scale changes in total ozone—such as a 10-percent drop on September 5—where meteorology would be favored as the driving factor. But even without these or similar conditions the hole would probably develop.

What does this mean for other parts of the planet? The scientists say it will be months before they will be ready to generalize from what they've learned in

Antarctica to the rest of the stratosphere. What they do know, however, is that CFCs have a lifetime of 50 to 200 years, and that there is plenty more of the chemical heading heavenward. Antarctica, with its unique meteorology, is perhaps a weak link in the stratospheric chain, but there is also no telling whether other stretches of stratosphere don't have soft spots that have yet to show themselves. We are pushing chlorine levels in the stratosphere higher every year—eventually even the sturdiest slab of stratosphere will be altered by the chemical invasion.

"The CFC industry has consistently taken the stand that even a chemical is innocent until proven guilty, and that we should wait to act until we see an actual depletion," Anderson says. "Well, we now know that this depletion is real, and that it is related to chlorine."

On September 17, an international protocol calling for a freeze and eventual reduction in CFC production in developed countries was signed by more than 30 nations at a meeting in Montreal. Anderson is convinced that the finding of chlorine at 500 times its normal levels in the Antarctic stratosphere, coupled with the record ozone depletion, will motivate a majority of countries to ratify the agreement, the first international protocol on any major environmental issue. The agreement will not mean that we will have to give up our air conditioners or refrigerators, but it will force CFC manufacturers to escalate the already substantial effort to find safe alternatives to the chemicals, alternatives that, at least at first, will increase consumer costs. However, Anderson points out, these costs are nothing when compared with the price we will pay if we allow an ever-thickening stream of CFCs to waft through the atmosphere.

"What we saw in Antarctica was a clear connection between high chlorine levels and ozone depletion," says Anderson. "Essentially, what we found was a low-temperature flame burning over an area the size of a continent. This is intolerable. There is no question that we should reduce the fuel for this flame. It is time we stopped using the atmosphere as a test tube for global chemical experiments."

Between flights ER-2 waits in hangar, with its nose opened for removal of experiments; NOAA scientists check instruments tucked into a bay on underside. Data it gathered proved CFCs are a cause of ozone hole.

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THE VISION IS PAYING OFF.

By Adrian Forsyth

Snakes maximize their success with minimal equipment

Lacking limbs to help capture or handle prey, these stripped-down reptiles have evolved ingenious ways to catch and eat almost anything

It was my first night at the La Selva research station in the Atlantic lowlands of Costa Rica. Half asleep, I strolled down the path to shut off the electric generator. Suddenly, I halted in midstep just as a mottled brown missile tipped with a gaping mouth launched itself at my toes. The force of the hog-nosed viper's strike dragged it along the path. But my foot had already recoiled out of range. My body had reacted instinctively to the snake before my mind had become aware of it.

Biologists such as Harvard's E. O. Wilson believe that when humans evolved in Afroasia in the midst of rich, venomous, snake fauna, we developed an instinctive reaction to snakes. As Wilson put it, "The brain appears to have kept its old capacities, its channeled quickness. We stay alert and alive in the vanished forests of the world." Snakes, whether they are venomous or not, can all startle us when we are suddenly confronted by them because snakes are highly stereotypic in form. Their basic shape does not vary like those of other animal groups such as mammals, fish and birds. Snakes are all stripped-down, streamlined predators.

Alexander Skutch, one of the pioneering tropical naturalists, captured the emotional impact of the economical serpentine form: "The serpent is stark predation, the predatory existence in its baldest, least-mitigated form. It might be characterised as an elongated, distensible stomach, with the minimum of accessories needed to fill and propagate this maw—not even teeth that can tear its food. It crams itself with animal life that is often warm and vibrant, to prolong an existence in which we can detect no joy and emotion. It reveals the depths to which evolution can sink when it takes the downward path and strips animals to the irreducible minimum able to perpetuate a predatory life in its naked horror."

Many people share Skutch's horror, but biologists find much to admire in what snakes have accomplished as predators working with limited tools. This homogeneous group, lacking limbs for prey capture and handling, manages to achieve one of the most varied diets of any group of predators. There are snakes that eat only slugs, that specialize in scorpions, that subsist on frog eggs. Some feed only on birds, others only on fish. To accomplish this diversity, snakes have had to make the most of their mouths.

Ancestral snakes were probably lizardlike and used a powerful bite to kill prey the way some large monitor lizards do. Burrowing snakes rely on biting with a little constriction to kill their prey. Boas rely far more on constriction and use the bite more to grab than to kill their prey. I can remember the first time I saw an anaconda draped in powerful loops along an Amazonian tributary. It looked big enough and strong enough to eat almost any animal in its habitat. And true to form, anacondas do eat caimans and mammals as large as wild pigs that weigh 100 pounds. Leopards fall prey to Indian pythons, and African pythons can swallow impalas.

When dinner weighs more than the diner

But the larger snakes are overrated as gourmands. The largest pythons weigh well over 320 pounds, yet the heaviest prey they can eat weigh less than half of that. The diameter rather than the weight of the intended prey tends to be the limiting factor; pythons overcome this limit to some extent by stretching the victim as they swallow it. In contrast, a snake such as a pit viper can kill and ingest a food item even heavier than itself. There is a record of a fer-de-lance eating a lizard one and a half times its own weight, perhaps the ultimate feat of terrestrial gluttony. (Some marine fish can eat prey of even higher multiples of their own weight, but in their buoyant environment they do not have to support the weight of the prey.)

Snakes began to diversify into 2,500-odd species only when they developed flexible and specialized mouths. As bones became smaller and evolved so that they

Strike threat by a toad-eater snake is a bluff, but it looks enough like a viper to scare off predators.

Photographs by Michael and Patricia Fogden

A hog-nosed viper uses one of its movable fangs, then the other, to work its mouth around a frog.

Spiny pocket mouse (right), is already dead, suffocated in the constricting coils of the tropical king snake.

A yellow morph of the eyelash viper gulps down an anole, a small diurnal lizard common in the tropics.

could shift relative to one another, modern snakes acquired the ability to open their mouths a full 150 degrees. Because the volume of an object increases exponentially with an increase in its diameter, a snake that can increase its gape by 10 percent can swallow items of at least 21 percent greater volume.

A wide gape enables a species like the African egg-eating snake to eat bird eggs that look impossibly large, three times as wide as the snake's head (p. 165). The tips of several of its vertebrae project into the gullet and pierce the egg, allowing the snake to squeeze the contents onward and then expel the nutritionally worthless eggshell. These specialist-snakes do all their eating during the bird-breeding season and then fast for the remainder of the year. Humans have been so impressed with the feats of egg-eating snakes that the ancient Egyptians, Cambodians, Hopi and Maya used snake images to explain lunar and solar eclipses as well as the onset of night and the winter solstice.

The tight-squeeze feeding strategy of the constrictors takes time, meaning that a snake might suffocate long before the end of the meal if it weren't for changes in its throat and mouth. Special muscles pull the windpipe opening in the floor of the mouth forward past the prey as it is being swallowed. The act of swallowing may also be assisted by muscles that rotate the jaw

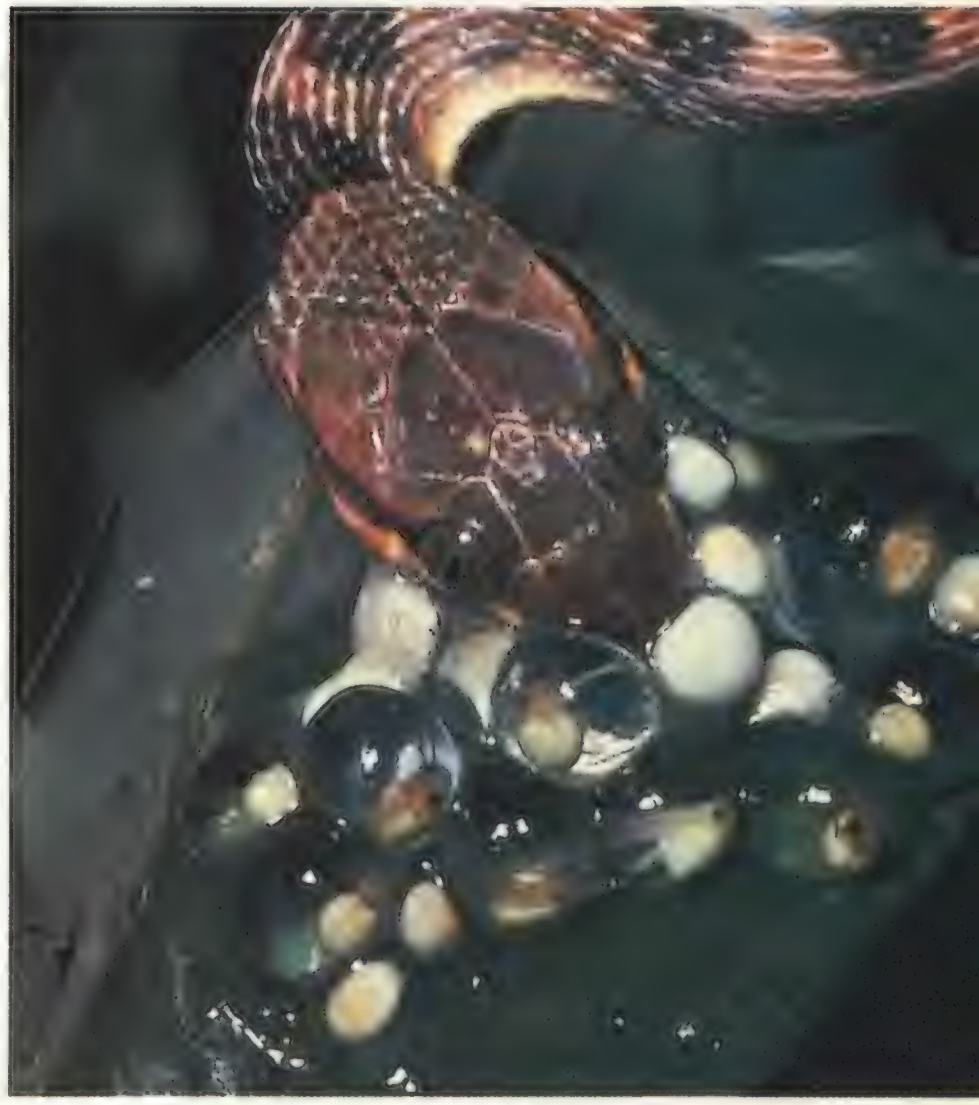
A false coral snake, whose colors mimic its highly venomous namesake, labors to ingest a rain frog.

forward, then pull it backward, and thereby "walk" the head of the snake over the victim.

It would be misleading, however, to claim that snakes achieve their diverse diets simply because they have wide mouths. Snail-eating snakes rotate their jaws in such a way that they hook the snail and pull it from its shell. (A little venom makes the job even easier.) Thus the snake is saved the difficulty of swallowing and digesting the shell. Other snakes use their serpentine form to probe rodent runways, to spelunk deep into ant nests and to twine their way like vines through the treetops.

One of the most elegant of these accessibility adaptations that I have seen is used by the blunt-headed tree snakes of Central and South America (p. 162). They specialize in dining on sleeping anole lizards. Slumbering lizards might seem like easy pickings, but the forest anoles behave in a way that thwarts most predators. They bed down far out on the ends of fern fronds, leaves and vine tips. The perch begins to vibrate whenever an animal starts crawling along the vegetation, and the alerted lizard drops off and runs away. A

A biology professor at Queens University in Ontario, the author spends half of each year in the tropics. His latest book is titled A Natural History of Sex.



Well-developed tadpoles are visible in some of the leaf-frog eggs being devoured by a cat-eyed snake.

Stripped-down predators do more with less

Blunt-headed tree snake has captured a lizard from nearby branch; the spider was an innocent bystander.

blunt-headed tree snake circumvents this early-warning system by extending its reach. Its body is shaped like an I-beam in cross section and its backbone and vertebral scales can hold the snake without sagging, enabling it to extend fully half of its body out into space without support. The blunt-headed snake has huge, bulging eyes that perhaps help it to spot a lizard at some distance. In any case, the snake crawls along a plant adjacent to a sleeping lizard and then reaches through the air without touching the perch and grasps its unsuspecting prey.

Wonderful as these structures are, people seem most interested in how snakes handle kicking, squirming, biting prey. A snake has a dozen different glands in its head and many of these glands produce toxic secretions. Some snakes have venom glands along with specialized muscles and grooved or tubular fangs that enable them to actually inject the venom. The venom we feel so threatened by is first and foremost a feeding adaptation used to subdue dinner. By using venom to immobilize its prey, a venomous snake has to rely even less on a strong bite, and its mouth, as a result, may become even more flexible.

Venoms exhibit a marvelous biochemical intricacy, rich stews of proteins and other complex compounds. It used to be thought that venoms acted as either neurotoxins, which paralyze parts of the nervous system, or hemotoxins, which destroy blood and tissue, and that snakes tend to have either one or the other. But in fact, many other toxic elements can be found in venom: there are blood-clotting agents; substances that reduce blood clotting; others that specifically destroy red blood cells, white blood cells and the cells of other tissues; bactericidal agents; and compounds that stimulate digestion. Cobras, kraits and coral snakes have a toxin that can stop a prey's heartbeat. Many venoms have the enzyme hyaluronidase, the "spreading" factor, which allows the toxins to move quickly through the system. Medical researchers employ these venoms to study nerve function and to help understand the blood-coagulation process. Some research has yielded practical applications: today similar compounds are used to treat blood-clotting disorders in humans.

Venom stops them where they are

Less is known about why snake species vary so widely in their venom composition, but differences in feeding strategies may be an important reason. Many sea snakes, for example, have extremely potent neurotoxic venom—researchers estimate that a gram could kill 500 people. With this poison, sea snakes can paralyze fish within seconds, an adaptation useful for feeding on mobile prey in a three-dimensional habitat. The same high potency is also found in the venom of pit

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vipers that forage on frogs and birds in the treetops and depend on a rapid immobilization of their food so that it does not get away.

In comparison, a large bushmaster has a much less lethal venom, which is primarily hemotoxic—but the bushmaster has a huge supply, appropriate for a patient, ten-foot-long, sit-and-wait predator that lurks for days camouflaged beside a game trail. When it strikes a large rodent such as an agouti, a bushmaster does not retain a grip on it. The snake lets the animal wander off and only after the victim has collapsed and is no longer dangerous will the snake go to it and begin to swallow it. The large volume of injected venom predigests the prey. A friend of mine who saw a human bitten by a bushmaster reported that the digestive impact was so severe that the man began bleeding profusely from the nose and mouth within minutes. This effect reduces the time it takes a bushmaster to digest large victims. An experiment with a related species of snake showed that injecting a rat with venom reduced the time needed for a snake to digest it from the usual 12 to 14 days down to only 4 or 5 days.

The fact that venoms are primarily a feeding adaptation also seems reflected in the seasonality of their production. Studies of snakes like the Persian and African carpet viper show that production of venom peaks in summer and sharply declines in autumn and winter —paralleling the natural cycle of feeding and fasting. Similarly, most venomous snakes avoid wasting venom on a nonfood item. Given the opportunity to escape, most do not bite, and even those that strike defensively often don't deliver much venom. Altruism isn't involved; venom is needed for feeding and is time-consuming to manufacture. For example, when a rattlesnake is milked, more than a month is required for it to fully replenish the supply, although it will have produced enough in three days to be dangerous again. Dried rattlesnake venom 50 years old has retained its toxicity, a considerable biochemical endurance feat.

Just as venoms may have evolved for a specific foraging strategy, some potential victims may have developed a compensating immunity, as may have some animals that prey on snakes. Mongooses are eight times more resistant to cobra venom than are rabbits in this country, which have not coevolved with cobras. Possums that evolved in the Americas along with rattlesnakes and pit vipers are highly resistant to their bites. The common Virginia possum can withstand the bite of large snakes such as the Eastern diamondback rattler with no ill effects. Possums have been injected with what would be up to 60 times a lethal dose of pit viper venom for other animals; the only result was a slight change in blood pressure, which disappeared within a half-hour. This resistance enables possums to hunt venomous snakes such as cottonmouths. On the other hand, possums—like rabbits—are easily killed by cobra venom because there were no cobras where they evolved.

I suspect that this sort of natural immunity is what allows snakes like the mussurana to specialize in eating other snakes, including the highly toxic fer-de-lance—a habit that makes the mussurana one of the few snakes appreciated throughout Latin America.

As a rule, of course, snakes are not appreciated anywhere. This is understandable, particularly in areas of Southeast Asia where a large rural population goes barefoot amid the kraits and cobras, and the death rate from snakebite still runs as high as 38 per 100,000 people. However, John Alcock, a behavioral ecologist at Arizona State University, points out that in the United States the risk of being poisoned by a reptile is 20 times less than that of being hit by lightning and 300 times less than the risk of being murdered by a fellow American.

Statistically, then, we have little to fear from our snake fauna. We may retain an instinctive aversion to the snake when we suddenly encounter one. But it is not us that snakes are hunting. Rather, it is their prey, the insects, slugs, centipedes and especially rats and mice, we need to hold in check. (Countries like India that have experimented with eradicating snakes have paid the price in huge losses of crops after they have been stored.) Most of all we can temper our aversion with respect and perhaps even with cautious admiration for a group of predators that has managed to make so much of minimal equipment.

Highly modified jaws of this African snake enable it to eat eggs; it fasts when birds are not breeding.

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NETWORKING

Cigarette punctuates self-portrait used on dust jacket of *Lone Cowboy*. James rolled his own, of course.

By Frederick Turner

The artist whose cowboys were based mostly on himself

Western writer and illustrator Will James was a true buckaroo whose inspiration came from the rope burn of personal experience

In a stand of pines on a country road south of Reno, Nevada, sits an empty log cabin with sagging corrals. Since many of the neighboring houses here in the Washoe Valley are new and expensive, the old cabin and corrals look strangely out of place. A few years ago the cabin was the headquarters of an ecology camp, and before that it was the clubhouse of a dude ranch for divorcées. But in its main room a tarnished bronze plaque above the fireplace tells you that this was originally the home of Will James, the famous cowboy writer and artist, who lived here with his wife, Alice, for several years in the mid-1920s. It was here, the plaque says, that James wrote and illustrated *Smoky*, a classic yarn about an indomitable horse that became a favorite of children and adults alike. Flanking the plaque are a studio portrait of James—handsome, hawk-faced beneath a creamy stetson—and a shot of James and Alice taken on the steps outside, shortly after they moved here. He was 32 and relatively unknown; she was 20.

Rediscovered after years of neglect

It isn't much of a memorial to an author who was as well known in his day as Will Rogers and Tom Mix but, looked at from a different perspective, it's not an altogether inappropriate one, either. A couple of generations of Americans have grown up knowing little, if anything, about Will James. Most of the 24 books he wrote are out of print. His sketches and paintings have been ignored for years. Yet even so, two of his books, *Smoky* and *Lone Cowboy*, are widely regarded as enduring contributions to Western literature. Not long ago, a major exhibition of his artwork was enthusiastically received in seven Western cities and last year two new James biographies were published. If it is true that James has been largely forgotten since his death more than 45 years ago, it is also true that he is currently being rediscovered.

James' popularity has always been based to a significant extent on the perception that he really was what he wrote about and drew. This was no Owen Wister out from Philadelphia, or Zane Grey, a New York dentist. This was the genuine article. How genuine he really was, though, only James himself could say. He misrepresented his origins and made up stories about his early years. He kept his closest friends and even his wife in the dark about where he came from. His parents and siblings knew next to nothing about the life he led after he left home. James' public image as a laconic cowpoke was legitimate to the extent that it was based on his considerable experience as one. It was also a persona he embellished and assiduously cultivated until eventually he came to resemble a character he despised, the dime-store phony. There was no

Mr. and Mrs. A. P. Hays, Scottsdale, Arizona

Cowboy holds on after taking hackamore off horse's head in an action-packed pencil sketch. James used 111 in signature as a carryover from days when he and two broncobusting pals called selves the "one-elevens."

question, though, about James' talent. He was a hugely gifted but deeply troubled man who struggled with his demons to the very end.

He burst upon the publishing scene like the lone horseman of Western legend who drifts into town trailing dust and mystery. Will James was not his given name, only the last in a series of pseudonyms. He was born Joseph Ernest Nephtali Dufault in the Quebec town of St. Nazaire d'Acton in 1892. His parents and siblings called him Ernest, and his surviving brother, Auguste, recalled that Ernest "knew how to draw as soon as he could hold a pencil." He had perfect coordination, Auguste Dufault said, and "his mind could photograph any thing, action or movement and that photograph was the model on which he would draw." At the age of 4, the boy spent hours studying the farm animals in his rural neighborhood and then, lying on the kitchen floor, he sketched them

on pieces of wrapping paper. His storekeeper parents were certain that he was a prodigy.

American cowboy life became the young artist's favorite subject. He had never seen a cowboy, a mustang or a longhorn, but he had seen pictures of them, and he had read French translations of Western adventures. Before he had finished grammar school, he knew what he wanted to do in life: he wanted to go West and become a rider.

By that time, the Dufaults had moved on to Montreal. Ernest quit school after the eighth grade and went to work in a local hotel. Out of his meager weekly pay he squirreled away enough money to buy a .32-caliber revolver, and he spent spare hours at an abandoned quarry where he practiced target shooting and quick draws. Meanwhile, he besieged his parents for permission to go West. Finally, in 1907, when he was 15, they consented. The boy knew nothing of riding or stock tending, nor did he know English. He had only $10, his revolver, a bag of cookies and his dream.

Lone Cowboy, Will James' fictional autobiography, is not an altogether trustworthy guide to his life, but used with caution, it tells us a good deal about Ernest Dufault's apprenticeship, first in the western provinces of Saskatchewan and Alberta, later in Wyoming, Nevada, Idaho and California. We experience his primitive wonder at the rough talk of cowhands, the life of the bunkhouse with its mingled aromas of wet wool, horsehair, leather and wood smoke. We share his fascination with the details of work around the corrals, his delight in the tack of a saddle shop. But we also see how hard an apprenticeship it was, beginning with the most menial chores—washing pots and pans, hauling and cutting wood, peeling potatoes.

Gradually the boy was given jobs more in keeping with his ambitions: a string of gentle horses to ride, then wrangling, then night-herding. And we can readily believe the writer when he recalls that he got many a "kick in the rear" for being in the way and that the hands used to tease him by saying, "We'd better kill him, he'll never be a cowboy." What gave them pleasure, James wrote, "is that I was so sensitive to what

James snoozed in the sun after a bronco tossed him onto a train track in Reno. He suffered a concussion.

Youthful Will showed off cowboy regalia at ranch in Canada where he was beginning to learn the ropes.

James and Alice, a onetime beauty contest winner, relaxed outside their Washoe Valley home south of Reno. It was here, with Alice's encouragement, that he wrote *Smoky* and other stories that portrayed range life not as cliché, but the way it really was.

they said." But, he added, "them boys knowed what they was doing. They didn't see nothing soft about me, and they noticed that if I did buck off I wouldn't get hurt easy, and there was no whining."

In time, the Canadian tenderfoot became a bona fide buckaroo, but then he rode straight into trouble. Here, as always with Will James, the facts are fuzzy. The best guess is that while still in the western provinces he got into a barroom argument with a sheepherder. Suddenly the man flashed a long blade, and the boy felt it slicing across his right cheek. He leapt clear of his attacker, drew his revolver and shot the herder, who spun to the floor. The boy fled to his hotel room where he was arrested.

What happened thereafter must remain a mystery. James claimed that his shot had merely grazed the herder, who apparently was shot again and killed in another brawl later that night. When this became clear, one story goes, James was released from jail. However, on at least three occasions in later years, he muttered a different story about setting fire to a log jail and escaping. In view of his behavior after the incident, this may well have been the case. He turned up unannounced at his parents' home only long enough to tell them he was going across the border and that thereafter they should address him as "C. W. Jackson." Some months later he was "Clint Jackson," then "Bill James," then "Will R. James."

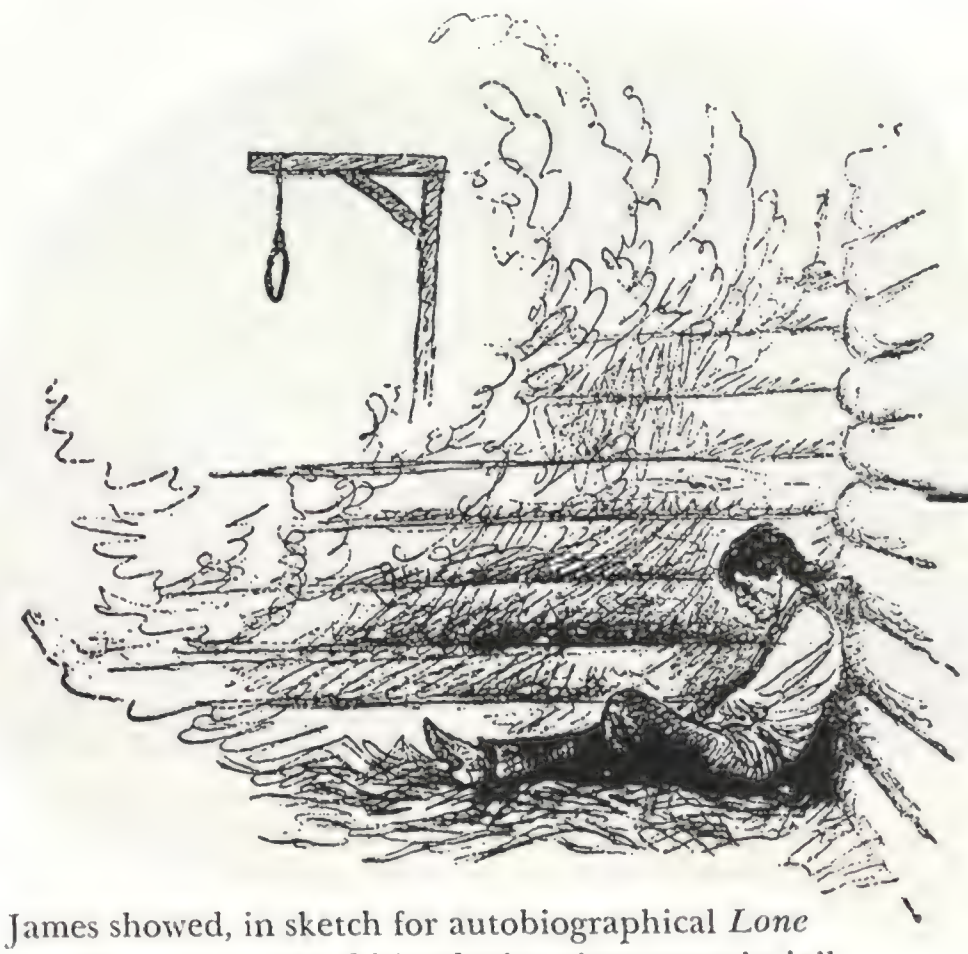
In early drawing titled "That first kiss," the kisser looks a lot like the artist. Hawklike nose is giveaway.

He was using the name Will R. James in the fall of 1914 when he was arrested in western Utah on a charge of having stolen some cattle in eastern Nevada and shipped them to Denver. The charge was true. James and a partner had been working on the Jim Riordan ranch in Nevada but had decided to drift south with the birds. On their way, they came across a small bunch of strays off a ranch at Shoshone and decided to drive them up to Oasis, Utah, and ship them. They moved only at night for nine nights, the winds already chilled and carrying snow; days they rested in the hills. At Oasis, James' partner took the herd by train to Denver while James stayed behind to sell their horses before meeting back up in Provo, Utah.

The very next day, while he dozed beneath a barber's lather, James overheard a conversation that told him too plainly the theft had been detected and suspicion had already settled on him. He immediately rode out of town and shortly after was arrested in the nearby town of Fillmore. At first he denied the charge, but after spending five months awaiting trial, he changed his plea to guilty and was sentenced to a year to 15 months in the Nevada State Prison. The file card accompanying his mug shot gave his name as "Will R. James," his birthplace as Montana and his occupation as "rider." It noted, too, a long scar running from his right cheek down to his mouth.

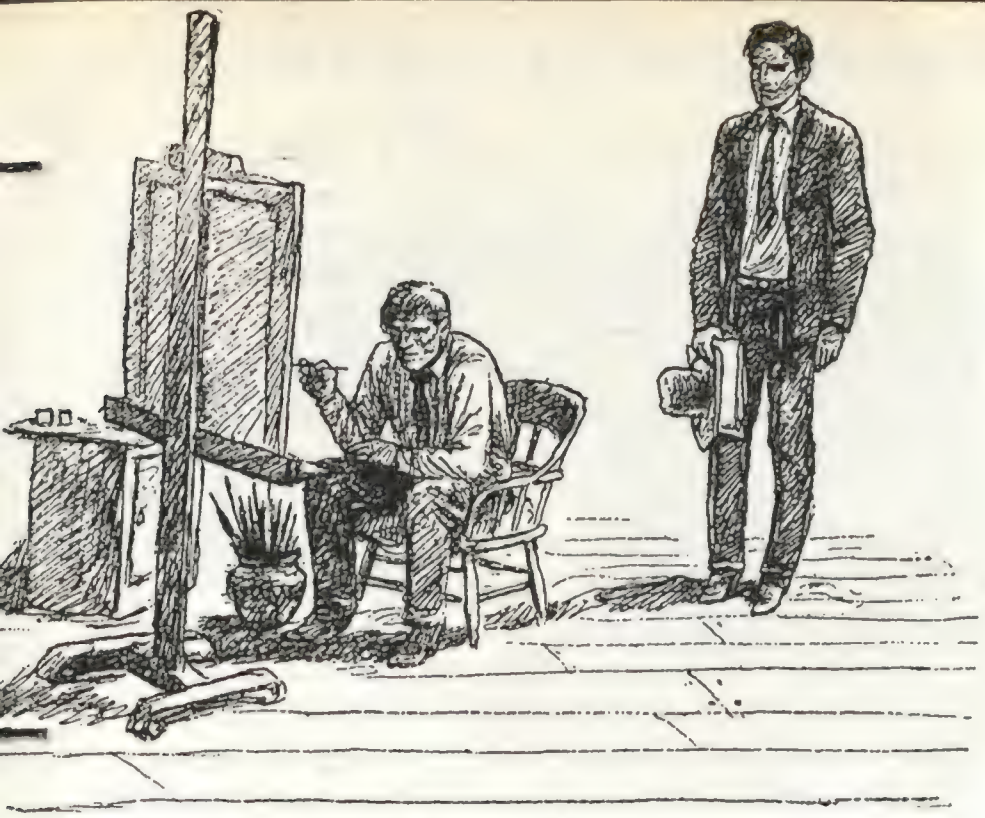
"Now I know how a mustang feels when corralled," he told a visitor to the prison, but he relieved the monotony by sketching and telling the guards stories that went along with the pictures. In time he became a favorite with them and was allowed to work with the prison remuda: he might be behind bars, but he was still a rider. When it was time to apply for a parole, he sent the board a three-frame drawing in support of his petition (p. 174). The frame captioned "Past" showed James rustling cattle; "Present" depicted him deep in thought in his cell; "Future" showed him in artist's togs working on a painting of a horseman. Additional text read: "The Turning Point: Have had ample time for serious thought and it is my ambition to follow up on my art. Will James." That application was denied, but he was finally paroled in 1916.

All along his winding trail he had in a way been following up on his art. There have always been cowboys who for their own enjoyment and that of their partners have depicted the scenes of their daily life, and James was one of these. At odd moments in the bunkhouse, in the fitful glare of campfires where he used charcoal sticks, in boardinghouse rooms using smudgy pencils, he sketched horses and riders, cattle and Western wildlife. He drew on the panels of boot boxes, on postcards, around the margins of pages ripped from catalogs, even on cigarette papers. Once



James showed, in sketch for autobiographical *Lone Cowboy,* what worried him during time spent in jail.

Frederick Turner has written books about jazz, geography and John Muir. Currently he is at work on another one, about landscape and literature.



James respectfully removed his hat when calling on Charles Russell—at least that's how he drew it in 1930.

in Alberta in 1917, James and a bunch of cowboys traveled the local rodeo circuit in an old Model T, and James drew cowboys and bucking horses all over it.

Some of his work was crude, but all of it was authentic and the boys admired that. One hand who trapped wild horses with James in Idaho in 1911 said he had noticed Bill around camp "drawing pictures of horses, women, cowmen and animals. I picked up some of the drawings I liked and saved them. When we moved camp, I gathered up some more of them. . . . I kept the sketches in my bed, next to the tarpaulin."

From time to time James made feints in the direction of an art career, but by the summer of 1919 he was still hanging around Reno, sleeping in alfalfa fields and barns, whooping it up at night with two friends. One day the three men, who had dubbed themselves the "one-elevens" (111s), decided to stage a bucking-bronc exhibition for the locals in hopes of collecting a few dollars. In an afternoon practice session, a horse called Happy pitched James onto a railroad track. He suffered a severe concussion and a lacerated scalp.

James convalesced at the home of one of his partners, Fred Conradt, whose teenage sister Alice tended him. While the slow days passed, the handsome cowboy talked wistfully about an artist's career and his dream of having a little cabin of his own where he could settle down. The accident had brought home to James that, at 27, he was getting to be an old man at broncobusting and cowboying. "The rougher and more dangerous a game is," he later observed, "the younger a man is when he quits it. Mighty few bronc fighters that's been at the game steady and hard are still at it when they're thirty years old. . . . I'd had horses fall with me in every way. . . . I'd been kicked and struck, rolled over the top of and dragged. . . ."

Four years later, James had begun to establish himself as an illustrator. He had sold a few drawings to *Sunset* magazine and received favorable attention from one of America's most famous illustrators, Charles Dana Gibson. He was also being encouraged by a small but significant group of backers and fans that included such prominent Western artists as Harold von Schmidt, Maynard Dixon and the great Charles M. Russell. But James had also had disappointing flings at art schools in San Francisco and at Yale, and despite Gibson's enthusiasm he had failed to crack the Eastern art circles. He and Alice were now married, but he could not support her with his art, and for a while they lived in a remote Arizona line camp where he tended stock. His body told him he could no longer be a broncobuster, but the unsold drawings in the corner seemed to tell him he was not to be an artist, either.

Alice thought he was missing the point of his talent. She remembered what a captivating storyteller he had been during his convalescence, and she encouraged him to write about the life he knew so well and accompany the stories with his illustrations. One day in 1923 he sat down in the little apartment they were then renting on a ranch outside of Reno and dashed off an illustrated story called "Bucking Horses and Bucking-Horse Riders," which he sent to *Scribner's Magazine*. He confided to Alice that it was "too easy done to be any good" and that when it was rejected he would never again try writing. It was, however, accepted promptly, and James was paid a handsome fee.

Once he got over the shock, he plunged into a spate of writing and illustrating that had a sort of frenzy to

A heavy smoker, James dreamed up good use for habit in deft cartoon, "Repelling a belligerent bruin."

Artist submitted this contrite request for parole while in Nevada jail for rustling. Application was denied.

it. He worked all day at his drawing board and desk, rolling Bull Durham cigarettes and refusing to call it quits until dinnertime. He quickly sold another story to *Scribner's*, another to the *Saturday Evening Post* and a three-part series to *Sunset*. Soon famed editor Maxwell Perkins was writing him to say that Scribner's publishing house would bring out James' collected stories as *Cowboys North and South*.

That book and those that fairly tumbled out after it—*The Drifting Cowboy* (1925), *Smoky* (1926), *Cow Country* (1927)—created a sensation. There was no one else in America doing that kind of work, and reviewers drew on superlatives to describe it. "A gorgeous and almost unbelievable book," the New York *Herald Tribune* called his first collection. "Each of the fifty pictures . . . is brilliant and as filled with violent action as an exploding dynamite stick." "Against synthetic manufacturers of oat-operas," said another critic, James stood out "like the moon competing against a streetlight."

Here, for the first time it seemed, the authentic cowboy spoke of his life. He spoke not of six-guns and shoot-outs, for generally James avoided the Wild West clichés, but rather of how the desert looked at dawn and sunset, and how easy it was to get fooled in it by mirages; of how it felt to get up on a late-fall morning on the high plains with snow on your blankets, your rope stiff as a cable and the remuda skittish in the makeshift corral; of the smell of hot coffee and biscuits in the pan; and most of all, of the feel of a good pony under you. "When I hit out that spring," he wrote in *Lone Cowboy*, "asetting on top of a good feeling pony, the morning sun ashining on fresh green sod, trees abudding and millions of birds asinging everywhere, there was no room in my chest for anything excepting what was all around, under, above and ahead of me."

He stuck to what he believed in

"In my writing," James told Perkins, "I've stuck to what I believed in more than to what people might like—Zane Grey's had men with one lung come out in our country and show the cowboys up in a couple of months' time. Owen Wister done pretty near as bad and I would never want to follow up on such styles just because people might be disappointed."

Obviously, readers were not disappointed either by the truths James conveyed or by his rough, free style. "Good English is fine," James announced in the preface of his first book, "but it don't git there." His lingo did. No matter that it was in fact highly stylized, a rangeland phraseology that never existed anywhere. With it James worked close to the border between effect and excess but rarely strayed over, and what he produced read the way cowboys *ought* to talk.

The illustrations had a similarly authentic impact. James was at pains to make the point himself that his drawings came out of the rope burn of personal experience. "If I can't feel it," he said, "I can't draw it." The immediate, inevitable comparisons were to his grand predecessors, Remington and Russell, both of whom had put in plenty of time in Western saddles, but by the end of the decade James had achieved a popularity that eclipsed even theirs. Like his writing, his illustrations were highly stylized: the cowboys hawk-nosed like James himself, long-waisted and bowlegged; the horses all mustangs; the cattle invariably longhorns, even though that breed had been superseded on the range years earlier. Replying to criticism of his cowboy type, James explained that what he had done was to "put all the cowboys I've seen and known along with myself in the same pot and all boiled down I got one character what covers over seventy-five percent of the range riders."

With the publication of *Smoky*, James' popularity soared. The book was quickly labeled the "*Black*

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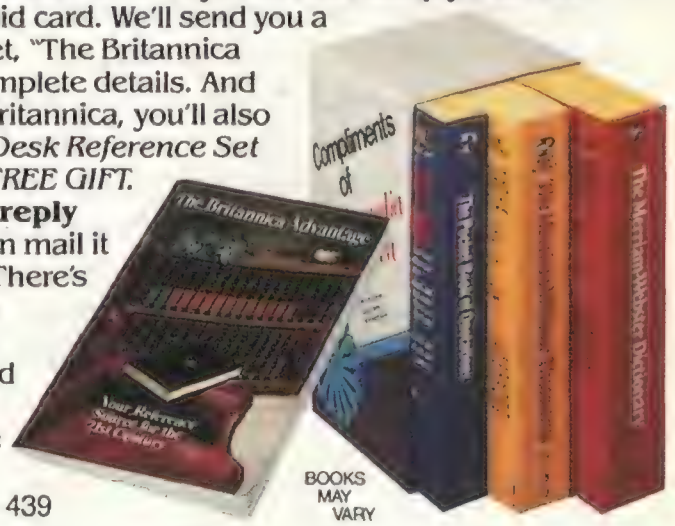


439

Miss Virginia Snook, Billings, Montana

Hobbled cow pony waits for its rider outside a line camp in oil painting done by James for *Lone Cowboy*.

Beauty of the cow country" and just as quickly it went through nine reprintings. By that time, the author was growing restless. Once he had said to Alice that all he ever wanted in life was a log cabin and a few horses in the corral. Now he wanted a big spread up in what he claimed was his birthplace, Montana, and he asked Scribner's for a loan. In 1927, he and Alice moved onto the Rocking R Ranch in the rugged foothills of the Pryor Mountains south of Billings with Alice's brother, Fred Conradt, as foreman. Here, James told his publisher, was a dream fulfilled. In the event, however, it proved to be the beginning of a disastrous downward spiral.

Instant fame and money are hard for anyone to handle, and James was utterly unprepared for either. After *Smoky* he was a full-blown celebrity, in constant demand at rodeos, parades, horse shows, barbecues, Hollywood parties, hunts and dude ranch events. As Tom Mix once said to Alice when she complained to him that she was losing Bill, "He doesn't belong to you, Alice, but to the public." But the causes of James' troubles went even deeper than that.

In coming to the West in 1907, he caught the last whisper of the traditional cowboy culture he had dreamed about in Montreal. By the time of his fame it was over, the range fenced, the cowboy basically a farmhand, the horse slightly anachronistic. James knew this, but he refused to accept it, and the Rocking R became his defense against the new realities. "You ask," he wrote Charles Scribner II, after the latter had helped him buy the ranch, "how much more land I'll need. Well, I only want what's close to me so no one can get near as progress creeps up. . . . I want it as a cow country, cattle & ponies on the ridges and creek bottoms and when I set up on a knoll looking at my little valley I want to see a rider once in a while and not a farmer hauling a load of grain—you savvy what I mean."

What Scribner's savvied was that their prized author was getting himself deep in hock and that in order to repay them he was committing himself to a killing schedule. Both Perkins and Charles Scribner warned him, but unaware of James' real history and of how crucial the dream of the old-time cowboy life was to it, they could scarcely sense the urgency of his need when he told them he had to have the ranch for inspiration.

One of James' great strengths as a writer and an artist was his ability to imaginatively project himself into his characters. With equal fervor, he had become Will James, rider of the old West. "Bill," said his friend and fellow writer, Ross Santee, "didn't know the difference between fact and fiction." The present fact was that to protect his fiction and wall out the realities of the new West, James plunged deeper and deeper into debt, buying up adjacent parcels of land as they became available. Under staggering financial, literary and social pressures, he sought relief and a further retreat from reality in alcohol.

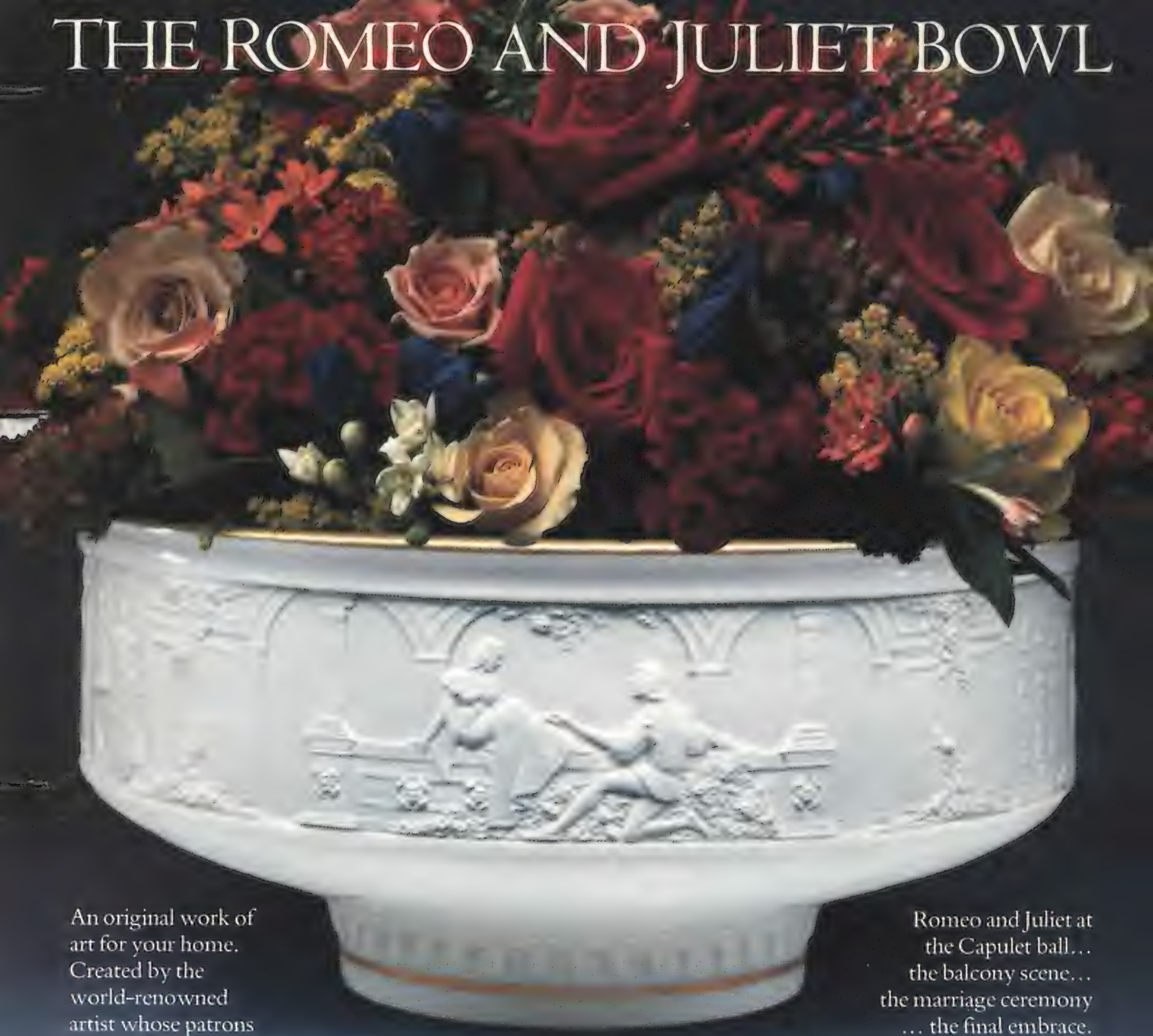
Like many cowboys whose work caused them to go a long time between drinks, James had for years been a binge drinker, a form of behavior that was accepted in the West as a kind of occupational hazard. Up on the Rocking R, though, he began to drink while working. He told Fred Conradt that whiskey helped him concentrate, and for a while, Conradt, knowing the tremendous pressures under which James worked, was willing to believe him.

Riding while under the influence

Some of the drunken stunts James now began to pull seemed harmless enough and to outsiders even colorful. There was the time, for example, that he suddenly veered away from a Manhattan rodeo parade and spurred his pony into the lobby of a hotel where he shot out the lights. And the time in Hollywood that he informed reporters that, yes, he always wore his boots and spurs in bed: they kept him from sliding off. And the time he dramatized his dislike of cities by building a campfire atop a Los Angeles hotel and cooking a pot of good, old-time range coffee up there. And, of course, there were always those who were willing to raise hell with James wherever he was —New York, Hollywood or the ranch, where a steady stream of guests abetted his deepening habit. Jim Hill, for instance, wastrel son of the old railroad robber baron, roared around the ranch's washboard roads with James in a big, black convertible, collecting caches of whiskey where local bootleggers had dropped them.

Inevitably, ugly patterns began to emerge. James

THE ROMEO AND JULIET BOWL



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would become violently abusive to Alice when he was drunk, and he began to womanize flagrantly. By the time he was in Hollywood for the filming of *Smoky* in 1933, he was exhibiting what some acquaintances diagnosed as signs of brain damage. Victor Jory, who starred in that first film version of the book, later recalled how James would begin a conversation with him, nod off in midsentence, then several minutes later regain consciousness and begin again on a wholly different subject. Alice finally gave up, determined to save herself at least. In their subsequent separation settlement, James lost his beloved Rocking R, which had to be sold to pay off his debts, and so became a drifter again, living with friends and at dude ranches. In 1936, he bought a house on five acres of land under the rimrock above Billings and spent much of his time working there.

Incredibly, amid the insane welter of drunks, debts and the dissolution of his life, James somehow managed to keep the copy and illustrations coming, averaging a book a year all through the '30s. He continued to think of himself as a rider with stories to tell. When he was sober, he still looked the part—lean, bowlegged, striking matches with the flick of a thumbnail to light another Bull Durham, talking of his work in a beguilingly concise manner. "I don't know nothin' about plots," he once told a reporter. "I just start out and write about what I know. Sometimes it works out like I planned, and sometimes it don't. There ain't no technique to it."

In the last year of his life he worked when he was able, with a kind of doomed valor, on what he believed would be the great American novel. It was the saga of three generations of cowboys, all of them named Bill, all of them defiantly refusing to acknowledge the realities of the new West. "THE COWBOY WILL NEVER DIE," he wrote in capital letters in the book's final sentence. This particular one did, of liver problems, on September 3, 1942—in Hollywood, of all places. During the funeral service at Forest Lawn cemetery, which was attended by Alice, a popular men's chorus sang "Home on the Range." Two days later, James' ashes were scattered from an airplane over his Billings home.

In his will, after the settlement of bills and debts, James left his estate to one "Ernest DuFault" of Ottawa, Canada. Doubtless, he meant to have named his brother Auguste. But symbolically, at least, the mistake made a point: he was his own unique creation and America has not seen his like since.

Thomas Gilcrease Institute of American History and Art, Tulsa, Oklahoma

James stopped action in painting of broncobusters but couldn't keep the West, or himself, from changing.

WILL JAMES
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NORWEGIAN REGISTRY

By Robert A. Hutchison

A tree hugger stirs villagers in India to save their forests

Applying the ideas and methods of Gandhi, his old leader, Sunderlal Bahuguna walks the hills, trying to avert ecological disaster

In the morning we had walked 12 miles uphill from Tehri to Chamba in the Garhwal Himalaya northeast of Delhi, and now in late afternoon we left for Jardhargaon, a village halfway up the 8,000-foot ridge to the south. I was working hard to keep up with a 60-year-old man who ate like a bird and had the stamina of an endurance runner, a once-imprisoned follower of Gandhi who is trying to save what is left of the forests of northern India.

On the path through a scrawny oak forest, the trees showed signs of heavy lopping. Many were mere trunks with a few leaves sprouting from them, and no branches. Only around the few local shrines were some trees left untouched. Even though it was after 6 P.M., mothers and their daughters were in the terraced fields cutting winter wheat. Other women were gathering firewood and fodder. We began an hourlong ascent to Jardhargaon through the terraces and stunted trees. As we climbed, the sound from the surrounding farms reminded us that in India one is never far from a baby's cry or the laughter of children. Halfway up the path we passed a woman carrying a small, freshly cut tree on her head. She was struggling under its weight and stopped, panting, to let us pass. Behind us, two men carrying nothing more than a transistor radio also passed her, ambling their way up to the village.

We arrived after dark and were greeted by the beat of drums. Our welcoming party led us to the *panchayat* (village council) house, where we removed our shoes and were seated on a dais. Jardhargaon had no electricity and a smoky kerosene lamp lit the room. More than 30 townsfolk crowded into the none-too-large space to stare at us. Two seventh-grade girls with long pigtails sang us a Garhwali folk song.

"What do the forests bear?" Sunderlal Bahuguna asked once they had finished.

"Soil, water and pure air," they replied.

To which he answered: "Soil, water and pure air are the basis of life."

Next morning, after meeting with some farmers, Bahuguna talked to the primary school children under a mulberry tree. He taught them a song about a tree that talked to passing children: "Do not touch me with an ax. I, too, feel pain. I am your friend. I bring you fresh air. I bring you water. I always bow down before you. Why do you cut me down?"

While he told the children about the chemistry of forests and how trees breathe, absorbing carbon dioxide and releasing oxygen into the atmosphere, another man selected six or seven girls and boys, and drew them aside. One boy was given an ax and taken to a tree, which he was to pretend to chop down. When the man shouted "Chipko!" the others ran to hug the tree.

"This is living media," Bahuguna said later. "TV is dead media. The children will take the message home and spread it to their parents. This is the most important function of a foot march."

At his ashram in the foothills of the Himalaya, the apostle of Chipko movement embraces a pipal tree.

Saving the forests for the people

Bahuguna is a spiritual leader of and driving force behind Chipko, a grass-roots movement in which villagers seize control of and protect their forests (the word *chipko*, in both Garhwali and Hindi, means to embrace or hug—as a tree). The movement is teaching them better land use, nursery management and reforestation methods. Bahuguna "has achieved more in 10 years than the forestry department could have done in 100 years," the conservator of forests for Tehri-Garhwal District told me. Chipko's success has forced the forestry department to change its role from policeman to teacher. In some villages—still too few, according to Bahuguna—it has opened nurseries and provided farmers with free seedlings.

Deforestation in the Himalaya has become a major ecological disaster. Its consequences are felt not only in the hill regions but hundreds of miles downstream in the Ganges plain, which feeds and waters one-third of India's 785 million people. Bahuguna estimates that forest cover has diminished by half in the past 30

Children hug a tree to protect it from an "axman," at right, in the Chipko game.

years. "The Himalaya are dying and if they are not saved, all of India will be turned into desert," he said.

I had first met him five months before in Kathmandu, at a seminar on the protection of the Himalayan environment. One of India's leading ecologists, he told the conference about his work among the poor village people in the Garhwal Himalaya. By going on foot marches, which have become the movement's most important tool, he spreads the Chipko message to remote hill villages where illiteracy is high, electricity is rare and "jeepable" tracks are few.

"Why don't you join us on one of our marches?" he had asked. I had accepted and was now embarked on the busiest ten days of my life. I had met him at midnight at the Indira Gandhi air terminal. He was easy to spot in his homespun uniform as he pushed a baggage cart through the crowds. The trip from Boston—he had lectured at Harvard on Gandhian history—had taken 36 hours.

"Come, we have no time to waste." His nephew, who owns a taxi, was waiting to take us to Dehra Dun, a six-hour drive north from Delhi. It is the largest city in the Doon Valley, a plain that lies between the Siwalik Range and the southern ramparts of the Himalaya.

Bahuguna explained that farmers from Thanao, a village to the east of Dehra Dun, were being forced off their land by an unscrupulous quarry operator and that Chipko activists were helping them defend their rights. The farmers had called a meeting for the following afternoon and were expecting Bahuguna to attend. We would also visit a disciple of Gandhi in Tehri. The former freedom fighter was opposing a hydroelectric project, which, if completed, would displace 70,000 people.

We reached Dehra Dun at sunrise, rested two hours, then took a bus to Thanao, 22 miles away. The village is wedged between a hardwood forest and the Sinsyarukhala River. Until the 1960s it had been a peaceful place. But in 1962 the Nahin-Barkot limestone quarry was opened five miles to the north, at the headwaters of the Sinsyarukhala.

The quarrying has heavily damaged the surrounding farmlands and forests. Hundreds of acres of forest were cleared to get at the limestone, causing calamitous erosion. Downstream toward Thanao, detritus from the quarry has turned the river into a scouring slurry that washes away the riverbanks, destroying farmland, damaging houses and sweeping away livestock. Families have had to abandon their homes without receiving a single rupee in compensation.

The lease had expired in 1982, but the contractor, Chattargun Gujral, was continuing to operate while his application for renewal was in the courts. The people of Thanao knew nothing about the legal proceedings until Dhoom Singh Negi, a schoolteacher, heard about it.

In September 1986 the villagers put up barricades to keep out Gujral's trucks and miners, and started planting saplings to replace the lost trees. With Chipko's help, they asked the court for an injunction to stop Gujral from reopening the quarry. For six months there was a standoff. Then, on a day when most of the villagers were in Dehra Dun, two truckloads of thugs drove to the quarry. They beat the handful of villagers on guard, tore down the barricades and uprooted the saplings. Two farmers were critically injured. The next day the villagers put up new barricades. Now they wanted help.

Waiting to welcome Bahuguna at the main Thanao crossroads were Dhoom Singh Negi and a small group of Chipko activists. The crossroads was no grand place. Two rows of shops—single-room cubbyholes, really, with open fronts covered at night by metal shutters—lined the upper half of the junction.

Seated on traditional blanket, Bahuguna urges his listeners to plant more trees.

The author wrote about truckers who drive the line from England to Iraq in the November 1986 SMITHSONIAN.

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As Bahuguna stepped off the bus, Negi guided him to shelter from the sun. At the hardware shop a rug was spread on the floor and everyone sat in a circle. They brought him up to date on the quarry. Two hours later, we walked to a second, larger meeting in another part of the village. About 40 villagers, ranging in age from 7 to 70, had gathered under a tree.

Bahuguna is a great storyteller. His face lights up as he talks. His smile is a big asset, and when he laughs, everyone laughs with him. People trust him. The villagers appreciate that he lives like them, is poor like them, and that his reasons for helping them are not materially or politically motivated. When he tells them that development should not be imposed by outsiders for the benefit of those who live far from the Garhwali hills, they love him for it.

The villagers were afraid the thugs would return. And they believed that Gujral's agents had offered 20,000 rupees ($1,500) to one of the plaintiffs to withdraw from the litigation. Now Bahuguna asks: "So what shall we do? Run away from the stone men like pygmies?"

One of the villagers suggests building check dams across the Sinsyarukhala to stop the murderous erosion. Someone else proposes planting more saplings. Both plans are adopted and a collection to buy the necessary materials produces 819 rupees ($63), much of it from the women.

Bahuguna then announces he will conduct a walk from Chamba, a village 30 miles to the northeast, to the Nahin-Barkot quarry, alerting other villages along the way to Thanao's plight as well as to the need to protect the forests. The march will arrive at the quarry in a week's time, as work begins on the first check dams.

The son of a district forest officer, Bahuguna was sent to secondary school in Tehri where, at the age of 13, he was recruited into Gandhi's Indian independence movement. The movement encouraged him to continue his studies at Lahore University, now in Pakistan, but his degree in political science and languages was postponed when he was detained during the British lockup of 1944.

Despite Chipko opposition, work has already begun on dam that will submerge 92 villages and thousands of acres of fertile land.

In Bahuguna's youth, Gandhi and his followers had walked from village to village throughout rural India, spreading the doctrine of nonviolent civil disobedience to bring down the British raj. Bahuguna went along on some of the local marches. Gandhi preached that the country's resources were being raped for British profit, which he believed was the root cause of poverty among the Indian masses.

Today Bahuguna considers the plight of the hill farmers in Tehri-Garhwal to be confirmation of Gandhi's theory. "One hundred and fifty years ago the village people here were well off. Then an Englishman began commercial timbering in the 1850s. When the raja of Tehri saw how profitable it was, he took control of the forests away from the people and reserved them for the big timber interests. Our deodars [a species of cedar tree] were chopped down to make railroad ties for the East India Company. Denied access to the forests, which traditionally had provided

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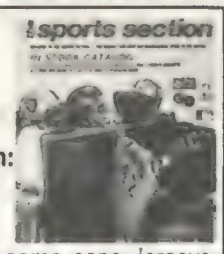

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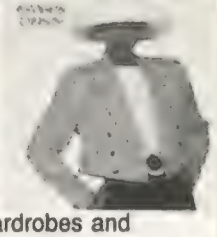

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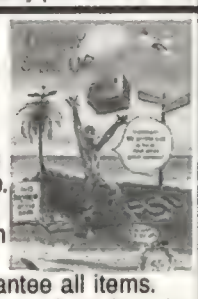

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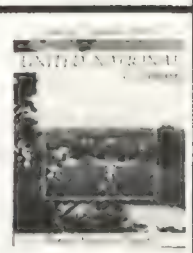

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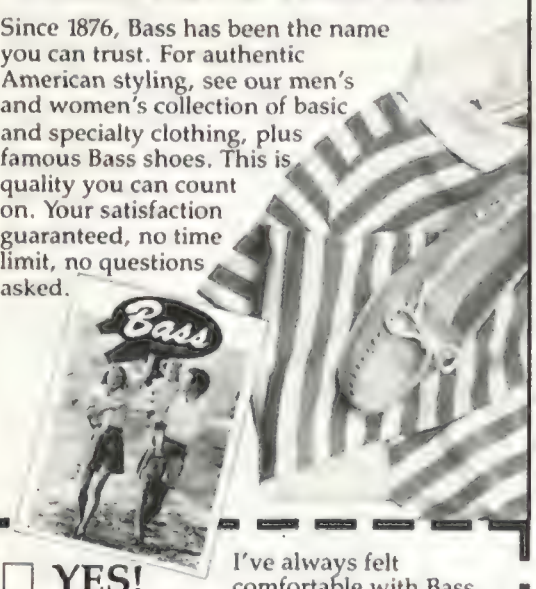

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them with fodder, fuel and food, the villagers were left with nothing," he explained.

Two days later I rejoined him at his ashram, ten miles east of Tehri. He showed me with pride how he and his wife, Vimla, had made their hilltop retreat self-sufficient in biogas fuel, in fodder, vegetables and dairy produce. They bought the property on the day they were married, 31 years ago. A forester's daughter from a neighboring village, Vimla had made it a condition of their marriage that Bahuguna give up politics and return to helping the hill people.

"I tried to find the causes of poverty among these people. I decided it was due to deforestation, which leads to soil erosion, murderous landslides and the drying up of water sources," he explained. The government auctioned tracts to contractors for timbering. The contractors overcut, always taking more than their quota, while the villagers were restricted to one tree each a year.

Bahuguna provided the spark that ignited agitation against the contract system, and then fanned the fires of protest until he won Mrs. Gandhi's backing for a moratorium on commercial timbering in the Himalayan forests of Uttar Pradesh. But it was the women who led the fight. Women, after all, spend a large part of each day scavenging for fuel and fodder. One of the first people in the movement to hug a tree to save it from being felled was the gentle schoolmaster, Dhoom Singh Negi. When the women saw what he was doing, they followed his example and saved the trees around their village from being felled by a regiment of axmen. Women had earlier formed human chains across access roads to prevent contractors from reaching their allotted timbering sites. As an ecological movement, Chipko's influence spread throughout India and across much of the world.

The next day we left for Chamba. When we arrived, more than 30 farmers, the conservator of forests and a dozen of his staff were waiting for us. Carpets had been spread behind the World War I memorial to soldiers of the Garhwal Rifles who had lost their lives fighting for the British. Bahuguna talked about the need for better forest and land management and the evils of limestone quarrying. And then we went to Jardhargaon.

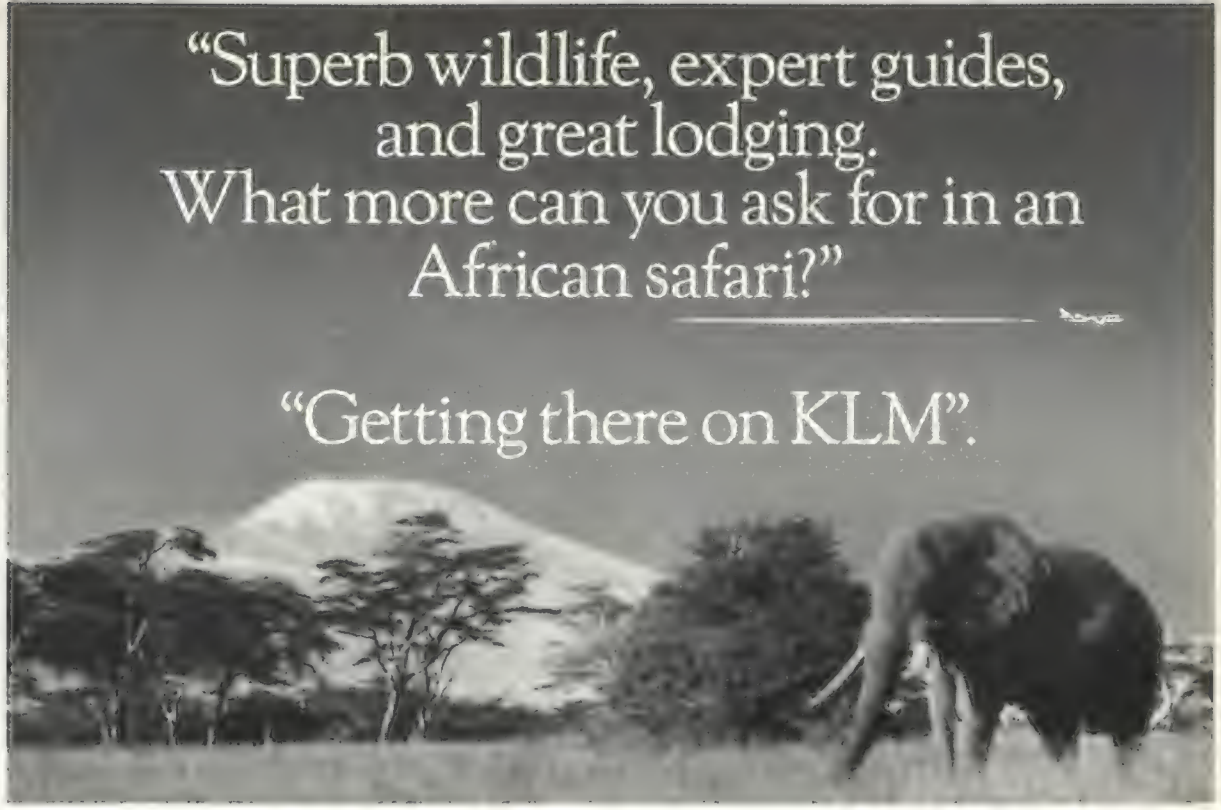
In Chamba, Bahuguna meets with farmers and the conservator of forests (on his left) to discuss the impact of a nearby quarry.

Youngsters head home with precious firewood that they have gathered illegally.

Each of the 250 families there has six to ten head of livestock, which must be fed daily with bundles of leaf fodder. The women scour the hillsides, bringing in as many as three bundles on their heads each day. Sometimes they have to walk miles to find fodder. Even little girls of 8 or 9 go out with baskets. Fodder trees (any broadleaf species) are cut back and back, until sooner or later they die. In addition, the women must gather firewood, as cooking is done on open fires. Wood is also used for making farm implements whose design has changed little since the time of Buddha. Pressure on the forests is therefore relentless. In a village the size of Jardhargaon, about 400 trees are lost in a year.

"The Chipko message is fine. But what do we use to cook our food?" one villager asked. Biogas plants are not the answer. They cost 12,000 rupees ($930) and for a family that earns $16 a month this is too much.

Bahuguna believes there are three answers. First, change the system of



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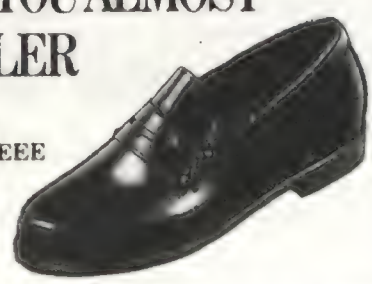

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land tenure: villagers must be given more control over the forests. Second, they must modify their eating habits: more soaked foods to replace cooked foods. Third, they must increase forest productivity. They must replant what they cut, not only with fuel and fodder trees, but with fruit- and nut-bearing varieties as well. The forestry department must provide seedlings.

After lunch we set out for the village of Benali, two valleys away. We were joined by a new Chipko recruit, J. P. Maithani, whom we called Brother J. P. The tree cover increased as we neared the top of the first ridge. From the pass we descended into another world, through an untouched oak forest that was alive with exotic birds and monkeys. About a third of the way down we crossed a clear, cool stream and, in spite of the leeches, the water tasted fresh and clean.

The stream cascaded into a narrow valley that ended in a staircase of terraces. The trees showed few signs of lopping and the underbrush was thick, providing perfect cover for the tiger that the people of Jardhargaon had warned us was lurking in these

A heavily lopped tree in a mountain village struggles to put out new leaves.

parts. Three houses nestled against the mountainside, and a man wearing a torn army jacket was winnowing freshly threshed wheat on a platform above the stream. Bahuguna talked with him for about 20 minutes. The tiger, he reported, had taken three buffalo, six goats and a dog during the past three weeks.

"Why don't you kill the tiger?" Bahuguna asked.

"Because the forestry department says we're not allowed to."

"Why don't you trap it?"

"We don't know how to build a trap. Anyway, what would we do with a trapped tiger?"

"Give it to the forestry department. They pay a bounty."

"Oh yes, and then I hear they come back with a truckload of tigers and release them in the forest to stop us from cutting the trees."

We left the winnower and climbed over the shoulder of another ridge, into a broader valley. Night had fallen by the time we reached the outlying houses of Benali. The first house on the path belonged to the *sarpanch*, chairman of the village *panchayat*. Its layout was traditional, with ground-floor stables for two buffalo, four bullocks, three calves, a cow and a donkey. The living quarters were over the stables—three rooms, one of which served as a kitchen, another for the three women of the household and a child, and the largest for the *sarpanch*, his brother and a son.

They offered us milk-tea while a meal of curried vegetables and lentils was prepared. Afterward the men arranged extra beds for us. We were seven in the same room that night, with the brother relegated to the top of a stack of metal trunks.

The day began at 5:30 with breakfast sweetmeats shaped like doughnuts. When we left for the main village, the *sarpanch* and his brother came with us. The women stayed at home to look after the animals and finish harvesting the wheat. Benali is so poor that when it came to teaching

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Psycholinguist Suzette Haden Elgin has presented her innovative self-defense principles in a variety of formats. She has given workshops and seminars all over the U.S., including verbal self-defense sessions for doctors, lawyers, and other professionals. Dr. Elgin has also created a self-defense tape and a training manual for people who teach her self-defense techniques.

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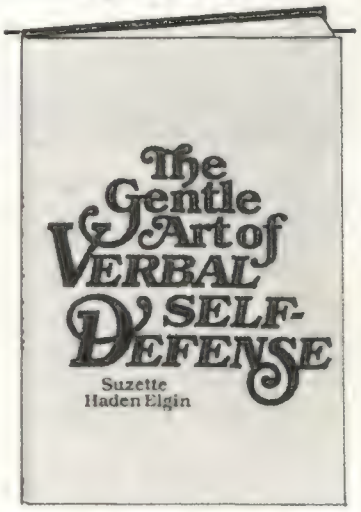

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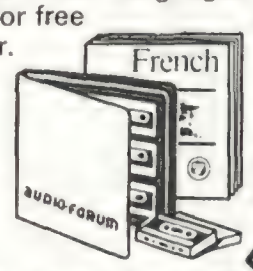

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Not one to waste time, Bahuguna catches up on some reading during a rest stop.

the children the Chipko game they had no tree to defend, only a pole. The children were miserably dressed. The villagers fed us at midday and then we had to relinquish the *panchayat* room to the local doctor.

Our reception at the next village, ten miles away, was cool. We rested a small distance from the topmost house while Brother J. P. explained who we were to the four men seated on the doorstep. We were finally invited to join them in the top room. Lit by a small kerosene lamp, it was maybe ten feet square. While we waited for the evening meal of lentils and coarse grain, which was prepared in another part of the house, Bahuguna outlined the Chipko movement. We discussed their problems, essentially the same as those of Indian hill farmers everywhere: weather, crops, drought and fear that the tiger would come over the hill.

Next morning they were eager to see us leave. We walked eastward until we could see the scar of the Nahin-Barkot quarry through the trees. After climbing to the top of the quarry, we descended toward Nahin-Kala, about two miles distant. We were able to see the Sinsyarukhala riverbed filled with rubble from the quarry. Nobody had come to meet us and no work had begun on the check dams.

A more woeful place than Nahin-Kala was hard to imagine. We were taken to a room near the center of the

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village and the children swarmed around us like flies. One 8-year-old girl had dark circles under her eyes and appeared more frail than the others. A low rumbling rasp came from deep inside her chest. Her eyes seemed to say "Help me." For her, help was in Tehri, 30 miles away, where a health center provided free medical care for the hill people. But it was unlikely that her parents would ever take her there and the consumption would in a year or two have completed its destruction.

After lunch we left for Thanao, where only Dhoom Singh Negi was waiting. The villagers, Negi said, had not begun the check dams because a child had been killed by lightning on the day construction was to begin.

Bahuguna was discouraged. "You see," he said, "I must start all over again. It takes time."

We said good-bye to Dhoom Singh Negi and, in the bus back to Dehra Dun, Bahuguna calculated that, during the four days we had walked through the Tehri-Garhwal hills, a half-million acres of forest had been cut down in the world.

Alone for the moment, Bahuguna climbs a trail near Nahin-Barkot quarry. He helped the villagers devise a plan to fight its effects.

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Book reviews

Who Got Einstein's Office? Eccentricity and Genius at the Institute for Advanced Study
Ed Regis
Addison-Wesley, $17.95

The Institute for Advanced Study at Princeton, New Jersey, was the original ivory tower. Founded in 1930 (it opened its doors in 1933) by an educational reformer named Abraham Flexner with money provided by the Bamberger department store family of New Jersey, the IAS was intended to be a refuge for the deepest of deep thinkers, an intellectual haven where scholars in the sciences and humanities could advance mankind's store of knowledge in an environment free from what Flexner called the "maelstrom of the immediate"—the pressures of teaching, meeting deadlines and coping with the unruly outside world.

When the institute's first resident thinker turned out to be none other than the most acclaimed scientist of the age, Albert Einstein, Flexner's visionary idea was off to an auspicious start. In the ensuing years hundreds of eminent physicists, mathematicians, philosophers and other scholars from Europe and the United States came to the serene, campuslike compound near Princeton University to let their minds and ideas roam free. The results included the conceptual origins, at least, of many of the most important scientific breakthroughs of this century, ranging all the way from computers and artificial intelligence to the hydrogen bomb.

In *Who Got Einstein's Office?* Ed Regis offers a rambling, sometimes bewildering and sometimes hilarious description of the fallible humans who populated this intellectual aerie in its early days. They bickered and feuded and occasion-

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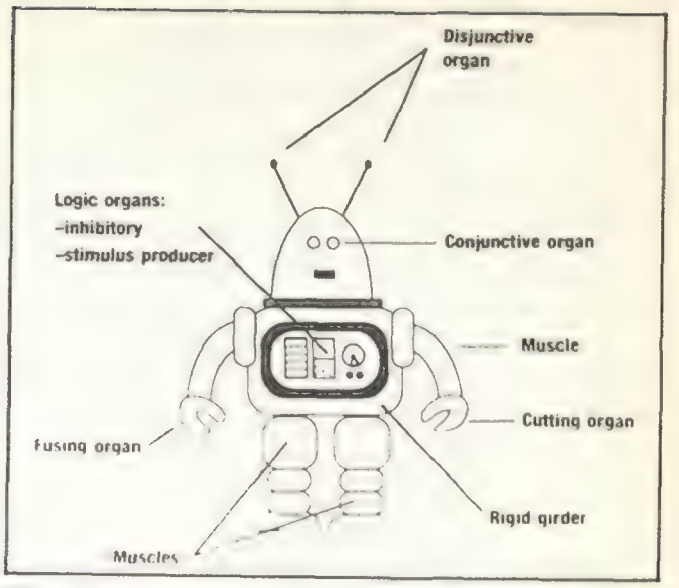
ally behaved outlandishly, it develops—rather like the rest of us. Flexner, for example, was so overprotective as the first director that he irked even the placid Einstein by screening him from a White House invitation the physicist was eager to accept. Einstein began writing "Concentration Camp, Princeton" as the return address on some of his letters and joined a clandestine plot to depose Flexner; it succeeded in 1939.

A philosophy professor and frequent contributor to *Omni* magazine, Regis draws especially sharp portraits of two of the institute's more fascinating luminaries, the logician Kurt Gödel ("The Grand High Exalted Mystical Ruler") and the multitalented mathematician John von Neumann ("Good Time Johnny"). Gödel was a mysterious Czech-born genius who possessed both the irreverence and the intellectual equipment to question everything, from the certainties of mathematics to the U.S. Constitution. When an official at his U.S. citizenship hearing explained to Gödel that a dictatorship was impossible here, the logician, who had studied the document closely and had uncovered a few flaws in it, cried "On the contrary!" He started to explain, but Einstein and another colleague who had come along as witnesses hushed him. Gödel's end was pathetic. He declined surgery for a prostate ailment and refused to eat because he believed the doctors were poisoning him. His death at 71 was officially attributed to "malnutrition and inanition caused by personality disturbance."

Johnny von Neumann was Gödel's temperamental opposite, a brilliant pioneer in computer science and robotics who also happened to enjoy wine, women, money, parties, good and bad jokes, and noise, together and separately. It was impossible to dislike von Neumann, a man capable of recalling entire books verbatim years after reading them, but one who could also forget why he was on his way to New York.

Von Neumann was courtly in the Middle European manner (he was born in Budapest) and hated to cause embarrassment. When a potential co-worker appeared at his door for an interview accompanied by a dog, which wandered about during their conversation, the courteous von Neumann waited until the end to ask the man if he always brought his dog along. The visitor replied that he thought the dog belonged to von Neumann.

One of his ideas was a robot that could replicate itself. Assuming a ready supply of material, the automaton would only have to "pick up parts and put them together, or, if aggregates of parts are found, to take them apart."



The "von Neumann machine," proposed in 1948, could have replicated itself.

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The gifted and controversial J. Robert Oppenheimer ran the institute between 1946 and 1966. When Red-baiters challenged his loyalty during the McCarthy years (his brother was a Communist) and took away his security clearance, Oppenheimer retained both his position as director of the institute and the support of Einstein, Gödel, von Neumann and the rest of the IAS faculty. But as Regis portrays him, Oppie was never the same afterward. He lost his confidence and began drinking so heavily that one colleague called his house Bourbon Manor.

The lofty and sublime arrogance of the thinkers attracted to the Institute for Advanced Study comes across as somehow beguiling; these are scholars who dare to believe that they can explain *everything*, that through their equations and solitary musings they can account for all of nature and its patterns and interrelationships ("I will a little think," Einstein would say). Maybe they can.

The book's main shortcoming for me is Regis' failure to make it clear exactly how these geniuses spend their days. It's always puzzled me, for example, how day-in, day-out long-range thinkers know when the workday is over.

Regis concludes by asking whether the Princeton savants are perhaps too free, too detached from the give and take and stimulation of intellectual discourse. He thinks maybe a few "prickly pears" would make things livelier and he blames Oppenheimer, in part, for stressing the need to "fit in" as an important criterion for selection. Abraham Flexner's original notion of a pressure-free intellectual "haven" turns out to be an illusion. A thinker does not escape pressure by retreating to a place where he is expected to cogitate and come up with ideas. As one of them observes, the anxiety level escalates when the ideas don't materialize and one is out of excuses. Freedom is its own pressure cooker. But at the same time, as Regis shows, it's also a splendid incubator of ideas.

Donald Dale Jackson
Connecticut critic and writer

The Kingdom in the Country
James Conaway
Houghton Mifflin, $17.95

Everyone knows the West is big. Everyone has seen, either on vacation or in calendar photography, those prairie sweeps and mountain vistas whose immensity can take the breath away. A few miles from my house, for example, lies

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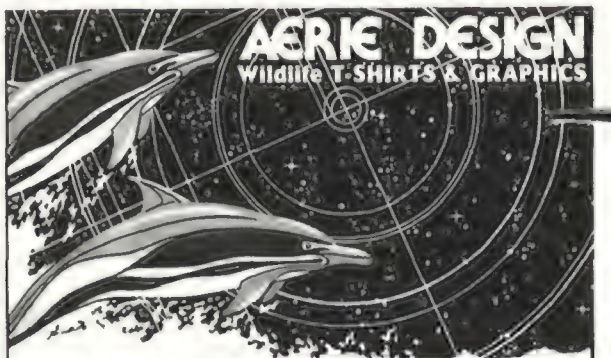

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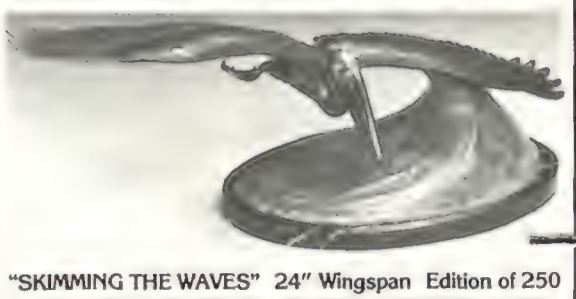

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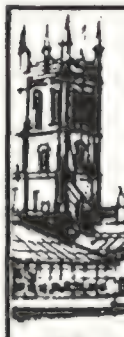

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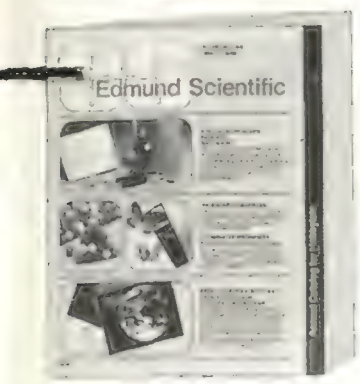

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Forsaking a feature-writing job at the *Washington Post*, Conaway jumped into his van and began his tour of a federal empire stretching from the Rockies to the Pacific, from Mexico to Canada. He doesn't editorialize, never once scolds or pontificates, but rather lets us see the use-misuse of public lands through the eyes of the people he interviews. Talk about your mixed bag! Our peripatetic author chases down an artifact hoarder, a marijuana grower, a grizzly chaser, a wild-horse wrangler, even a present-day gunslinger. He had to corral a few "normal" people as well—loggers, ranchers, sheepherders, BLM and FS employees—for only a reasonable mix of Flakes and Steadies could have made this the meaningful look at the modern West that it is.

It's also a morality play. There are the good guys and the bad guys, the careless and the committed, the full-pocketed and the underpaid. Gradually, with each new profile, a pattern of land abuse emerges, on both sides. Ranchers pay only a fraction of the cost to run their livestock on public land (the fees are $1.35 per head per month for cattle, 23 cents for sheep), yet BLM continues to clear inappropriate areas for even more grazing, at tremendous expense. Two thousand acres of Douglas fir (value $1.6 million) sat uncut because some bureau declared it a spotted-owl habitat, yet countless gypo (small-scale) outfits harvest prime timber for which they hold no lease permit. Strip-mining operations, wild-horse programs, all have their own dichotomies, their own horror stories. Trespass on one hand, mismanagement on the other.

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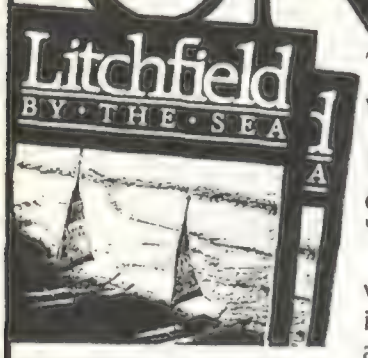

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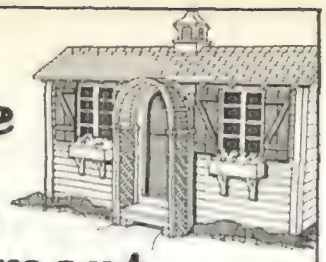

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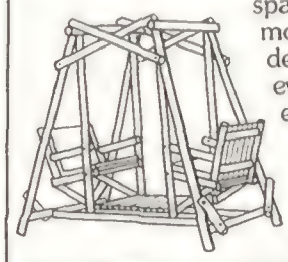

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than poaching. And it isn't new. Robin Hood and his Merry Men did it in Sherwood Forest long ago. And we are reminded of the angry but poignant question Sitting Bull put to George Custer when the general led the first gold seekers into the Black Hills: "What are you doing on my land?"

As for the mismanagement, our bureaucracies haven't reached Zero Defect status either. They too often fire cannon to kill flies—which are there because the wrong forms were used at the time the screens were ordered. You know the story. Much of this enforcement difficulty is explained by simple arithmetic. Excluding the state of Alaska, BLM administers slightly less than 180 million acres of public land but employs only ten thousand people.

"The West is still an awesome generator of product," writes Conaway. It's true. Grazing, mining, logging and other fees earned BLM $227 million in 1985. Oil, gas, coal and mineral leasing earned $1.2 billion. FS added receipts of more than $1 billion.

Conaway's presentation is admirably eclectic, which suits a vast and varied country. But out of this smorgasbord of viewpoints, there remains for me one plate that won't clean up, the one painted WHAT TO DO WITH THE WEST? It is the worst kind of conceit for us Westerners to believe that we alone know the West; yet being raised in it, making a living in it, we can't help but absorb some of its flinty self-assurance. Isolation does that, a bounty of wind and sky—after all, incredible distances lie just beyond the town. Conaway calls public lands an "inadvertent refuge for the enduring notion of the West."

But ever since Horace Greeley passed on J.B. Soule's instructions about where people should go, this region and its land-use policies have attracted controversy the way mountain timber attracts lightning. Sects and factions and ideologists everywhere abound, including those backpack-wearing purists who want their wilderness roadless and those in the yellow Volkswagens who do not. Soon we will have more Save Something clubs camped in our meadows than we have meadows. Some of us Westerners wish people would quit coming out here to solve our problems. Sometimes, we wish we could have told Horace Greeley where to go.

William Dieter
Denver novelist

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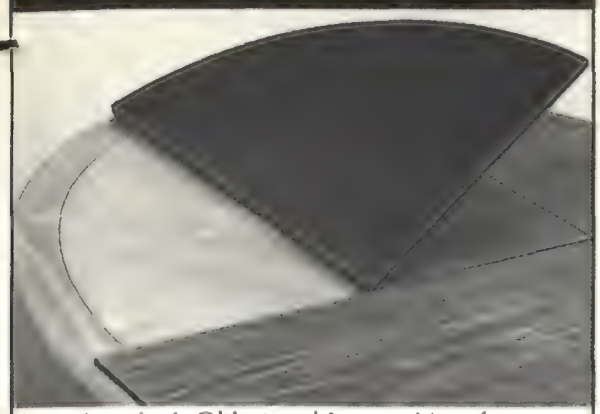

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Additional reading

Horizons (p. 12)

The Sociology of Science: Theoretical and Empirical Investigations by Robert K. Merton, University of Chicago Press, 1973

"Theory Choice and Problem Choice in Science" by Harriet Zuckerman, *Sociological Inquiry*, Vol. 48, No. 3-4, 1978

Solar cars (p. 48)

"Work on Solar Car Enriches Engineering On Many Fronts" by Malcolm W. Browne, *New York Times*, November 10, 1987

"Solar Power Rolls On" by David Clark Scott, *Christian Science Monitor*, November 13, 1987

"Driven to Extremes" by Josh Hammer, *Los Angeles Times*, October 25, 1987

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Pitcairn Island (p. 92)

Fragile Paradise by Glynn Christian, Little, Brown, 1982

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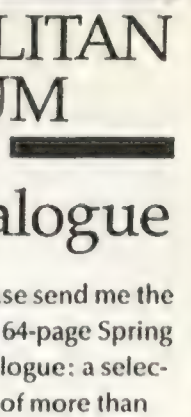

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Pitcairn Island by David Silverman, World Publishing Company, 1967

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Smithsonian highlights

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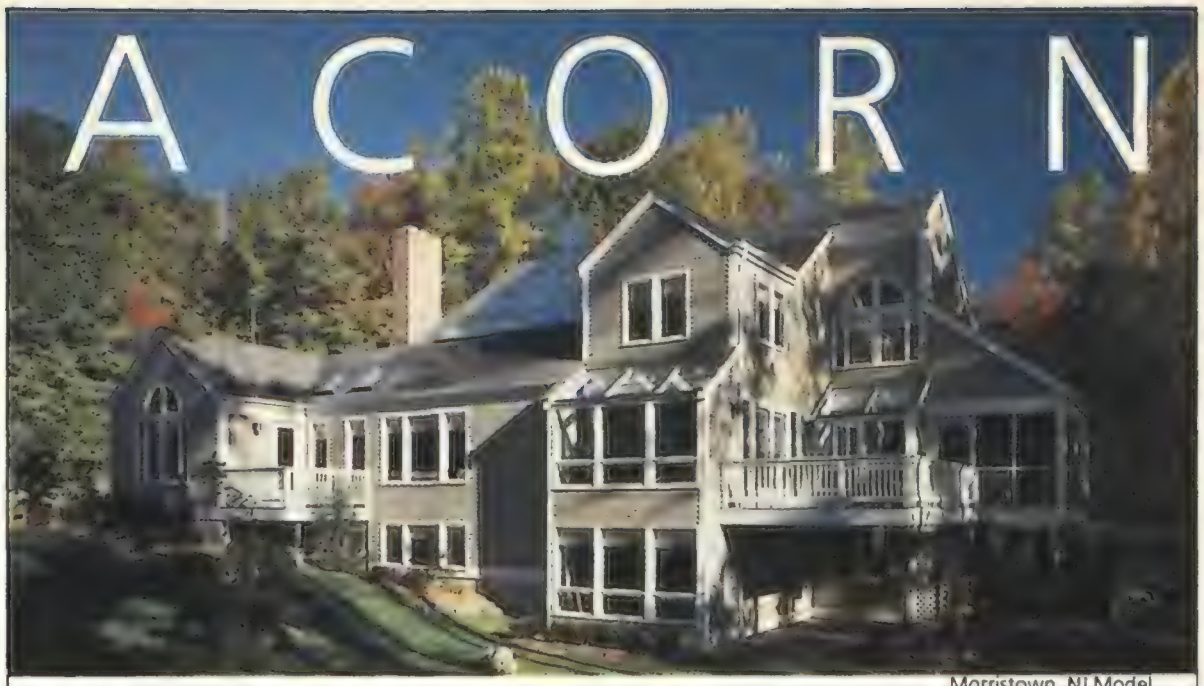
Special February exhibits and events

National Museum of Natural History
Birds and Flowers of the Fifty States: The Singer Stamp Series (through March 27) Paintings by Arthur Singer, one of America's foremost wildlife artists, and his son Alan. See *Highlights continued* (p. 210).
Butterflies and Their Flowers: Paintings by Biruta Akerbergs Hansen (runs indefinitely) Ten of the most common yet most resplendent butterflies in North America.

National Museum of American History
The Search for Life: Genetic Technology in the 20th Century (through March 31) Molecular biology—its history, its applications.
Symbols and Images of American Labor (through July 1988) The iconography of organized labor.

National Museum of American Art
Special Delivery: Murals for the New Deal Era (through September 11) Seventy paintings, drawings and sculptures.

Hirshhorn Museum & Sculpture Garden
Central European Art Since 1960 (February 18-April 17) A survey of the expressionist impulse in central European art of the past three decades.



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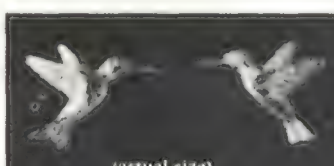
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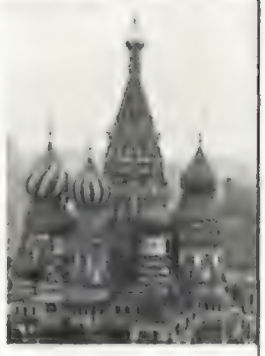

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National Museum of African Art
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African Art in the Cycle of Life (through March 20) Sub-Saharan masterworks.

National Air and Space Museum
Focus on Flight Photography Contest Winners (through July 1988) Prizewinning photographs of the museum, its visitors and exhibitions—an amateur competition.
Voyager: Around the World Without a Pit Stop (runs indefinitely) Exhibition of aircraft that made record-breaking flight. See *Around the Mall* (p. 28).

Cooper-Hewitt Museum (New York)
Color by the Yard: Printed Fabric 1760-1860 (through March 13) A century in the development of printed fabric; examples from around the world.

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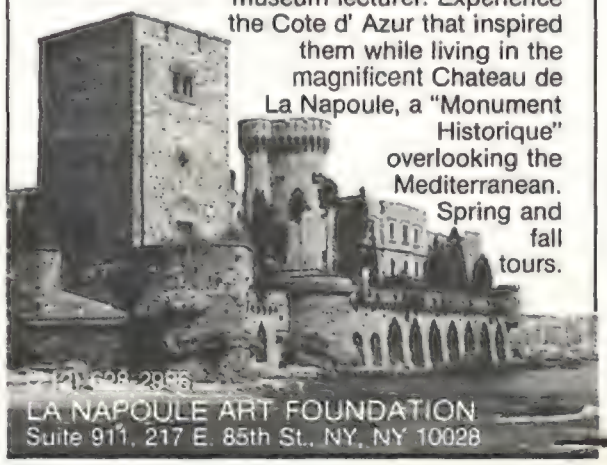

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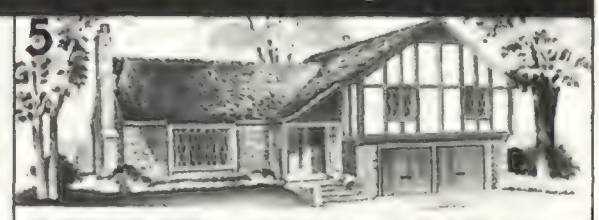

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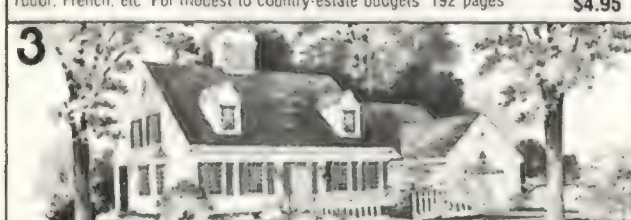

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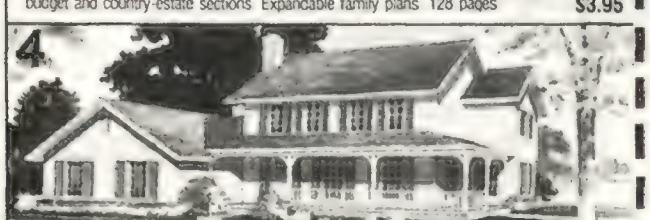

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Resident Associate Program

To become a Resident Associate, or for fee and ticket information, call 357-3030. Here are some February events:

An Evening with Poet Allen Ginsberg (February 26; 8 P.M.) One of the most important American poets of the century reads selections from his work.

An Evening with Nigeria's Foremost Author, Chinua Achebe (February 2; 8 P.M.) Provocative novelist discusses his long-awaited new novel, *Anthills of the Savannah.*

Chanticleer! (February 14; 3:30 P.M.) Washington debut of popular a cappella ensemble in special Valentine Day performance—madrigals to Broadway hits.

My Friend Ivan Lapshin (February 4; 8 P.M.) Washington premiere of the 1984 Soviet film. Adventure portraying life in a Russian village during Stalin era.

Smithsonian Institution Traveling Exhibition Service

SITES circulates exhibitions to hundreds of cities outside the Washington area. To sponsor one of the shows in your community, write SITES, Smithsonian, Washington, D.C. 20560. Here are some February exhibits:

Bettendorf, Iowa (February 6-May 1) *Soundtracks*, Bettendorf Museum.

The Bronx (February 11-March 27) *Master Watercolors and Drawings from the Norton Gallery of Art*, Bronx Museum of the Arts.

Farmington, New Mexico (February 20-March 20) *Spectacular Vernacular: Traditional Desert Architecture from West Africa and Southwest Asia*, Farmington Museum.

Nashua, New Hampshire (February 6-March 6) *Black Women: Achievements Against the Odds*, Arts and Science Center.

New York City (February 6-May 22) *A Russian Impressionist: Paintings and Drawings by Leonid Pasternak, 1890-1945*, Jewish Museum.

Smithsonian Seminars

Mohonk Mountain House
March 27-April 1

Spend a delightful week at this magnificent lakeside Victorian resort in New York.

The Art and Craft of Creative Writing
Study the various techniques of writing with SMITHSONIAN columnist Edwards Park.

The New Eden: A Century of American Art
Art Historian William Kloss explores works by the Hudson River School artists, the Luminists, and Homer and Eakins.

The Golden Age of Song
Acclaimed jazz pianist John Eaton shares music of Porter, Gershwin and others.

Washington, D.C.
April 24-29

Combine a pleasure-filled visit to the nation's capital with seminars that highlight Smithsonian research.

American Antique Furniture
Explore major 19th-century styles during lectures by historian Oscar Fitzgerald and a visit to Winterthur.

Printing from Nature
Learn the fine techniques of printing directly from natural objects during hands-on workshops with noted artist F.G. Hochberg.

Photojournalism
Smithsonian photographers and guest experts introduce you to the fundamentals as you document life in Washington.

Adventures in Archaeology
Tour the exhibition "Caesarea on the Sea" and enjoy lectures by archaeologists who have excavated this remarkable city.

Crosscurrents in European Art
Study the painting and sculpture of 19th-century France and other European nations with art historian William Kloss.

University of Southern Mississippi
May 17-20

Enjoy Southern hospitality in a college setting during seminars in Hattiesburg. Programs include Edwards Park's popular course on creative writing and a fascinating look at Southeastern Indian cultures with archaeologist Jerald Milanich.

Write Smithsonian National Associates, 1100 Jefferson Drive SW, Washington, DC 20560 or call (202) 357-1350 for seminar brochures. For tours, see page 111.

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Highlights continued

The Singer stamp series

Paintings of the birds and flowers of the 50 states by a father-and-son team are on view at Natural History

In 1980 the U.S. Postal Service asked eminent wildlife painter Arthur Singer to take on a special project—the design for a set of commemorative stamps depicting the birds and flowers of the 50 states. An expert field naturalist who had traveled widely to study birds in their natural habitats, Singer was uniquely qualified for the assignment and, with his son Alan, a noted botanical artist, he produced a singularly lovely series of paintings. Issued in April 1982, the stamps became immediate best-sellers.

The designs for these stamps, along with selected illustrations done by the Singers for the 1986 book *State Birds*, are on display at Smithsonian's Museum of Natural History through March 27. Singer has been strongly influenced by the work of the great artist-naturalists—chief among them John James Audubon. "The same ability to abstract the pure essence from nature that is the hallmark of Audubon's watercolors reappears in Singer's paintings," says the show's curator, Martina Norelli. "Singer's work projects his love for the natural world."
Diane M. Bolz

One of five composite designs also commissioned by the Postal Service, this painting represents the entire series.

The mockingbird, or mimic thrush, and the magnolia are symbols for Mississippi.

Arizona took cactus wren and saguaro cactus blossom as emblems in 1931.

Common loon, showy lady slipper stand for Minnesota, first to adopt a flower.

The familiar Baltimore oriole and black-eyed Susan are from state of Maryland.

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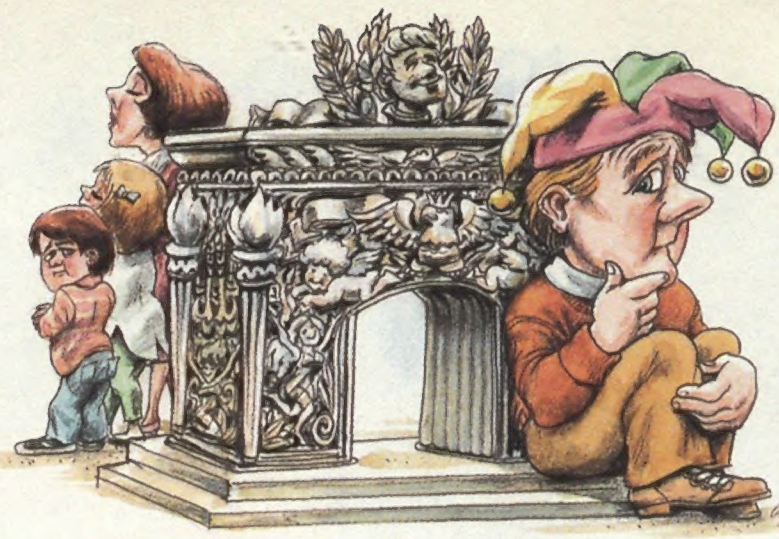
By John Skow

'Triumph,' 'biumph' or, maybe, 'monumph'



"The great vaults and transepts of the English language soar too loftily for times like these, which are not the best, not the worst," says the family fool, holding the ice cream carton and serving spoon, and thus the attention of his three children, wife and cat. "At our last session I spoke of shabby grammar and slovenly word choice. . . ."

Remembering that lecture, the elements of the nuclear family radiate hostility:

"Him and I," says one particle, a neutrino.

"Loan me a dollar," says another.

"Far out. Cool. Weird. Fan-TAS-tic," says a third.

"Oh God," says a fourth. The fifth curries a hairball.

The seminar leader puts down the rebellion. "Grotesque," he scolds, "and growing tesquer." Ritual groans follow this jest.

Now, however, the family is scattering. He corners the positron two strides from the safety of the TV room.

"For example," he says, "consider the word 'triumph.'"

"A triumph is a victory so splendid that an 80-foot arch must be erected to commemorate it, through which, to the cheers of rejoicing multitudes, the victor rides along a petal-strewn marble thoroughfare. Wailing captives are tied to the axles of his chariot, and wagonloads of jewels and precious oils trail the procession."

"Oil?" The positron, who is also the family's economic royalist, admires OPEC. He has been edging away, but now he stops for a moment.

"Just so," says the pedant. "And if a President ever manages to put a working energy program across, he should be drawn along Pennsylvania Avenue in an out-of-gas Toronado pulled by white mules, with the public relations staff of some GREAT OIL COMPANY chained to its hubcaps." The positron, who is familiar with the speaker's stand on the institutional advertising of energy companies, rolls his eyes and disappears in a cloud of disgust.

The family fool now directs his remarks at the cat, who is taking notes in the middle of the kitchen floor, and the neutrino, who is opening a can of cat food. "We speak of triumph when a baseball player hits .282, and when one of half a dozen self-swollen mediocrities wins a plurality in a primary election."

The neutrino scoops soya-mouse into the cat's bowl, and flees. The cat circles the food. The lecturer goes straight to the point. "Such achievements are not triumphs. A humbler word is needed. 'Biumph' suggests itself for accomplishments that, though praiseworthy, do not merit ceremonial arches or wailing captives. Beating a younger tennis player in a club tournament is a biumph. A tax audit resulting in a refund and an apology from the IRS is a biumph. So is a word of admiration from a teenage child.

"Most victories are not so glittering, however; an achiever who is asked to accept an honorary degree and to deliver a commencement address, for example, does not allow himself to feel biumphant. He understands that such requests are made only of those who are over the hill and thus no longer threats to decency. At the same time, a modest smarm of self-approval is not out of place, because to be over the hill implies that one has, unlike most plodders, found a hill and ascended it before—yes, yes—once more stumbling downward to the swamps."

Now the cat, too, vanishes in search of quiet or a dinner with legs. The lecturer waters a coleus and directs the remainder of his homily to it. "The proper emotion for the over-the-hill climber is, of course, monumph. However," he informs the plant, "not every day brings an honorary degree. Indeed, many a citizen goes to bed filled with deep satisfaction after a day in which neither he nor any member of his family has been eaten by fire ants or struck dead by a meteorite. His satisfaction is zero-based, like that of the horseplayer who is glad he broke even because he needed the money. He is nullumphant, and he sleeps like a baby."

The coleus seems attentive. The lecturer thinks of how he might continue his remarks. Quadrumph? Quintumph? Splendid coinages, but not of much practical use unless someone should repel an interplanetary invasion *and* receive a refund from the IRS. What else? The coleus waits and the thinker reflects.

His wife enters the room, wearing her coat and carrying his. "School board meeting," she says, rolling her eyes in disgust as the positron had done, but not disappearing.

The family fool puts on his coat, checks his pockets for suicide pills and then leans in at the door of the TV room. "If the Nobel Prize committee calls . . ." he begins.

"We'll say it's your bowling night," the neutrino, the positron and the third particle, a quark, yell in chorus.

"You tell us that every week," says the quark, the youngest and most literal-minded of the particles, "but they never call. I don't think they're going to because you're silly."

"Duck, here comes another round," the fool sadly replies. Then he walks to the car with his wife, head high, borne along by a swelling conviction of negumph.

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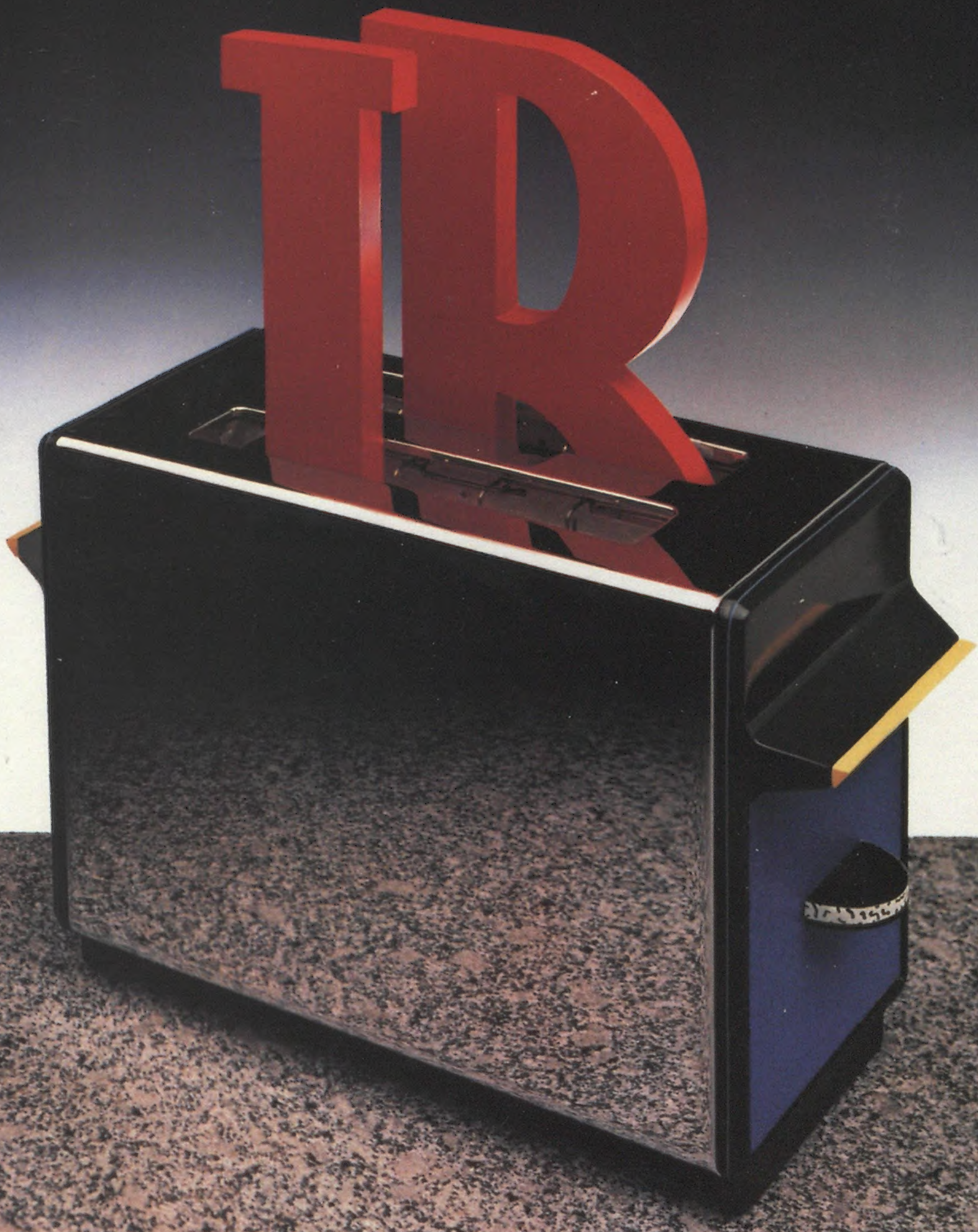

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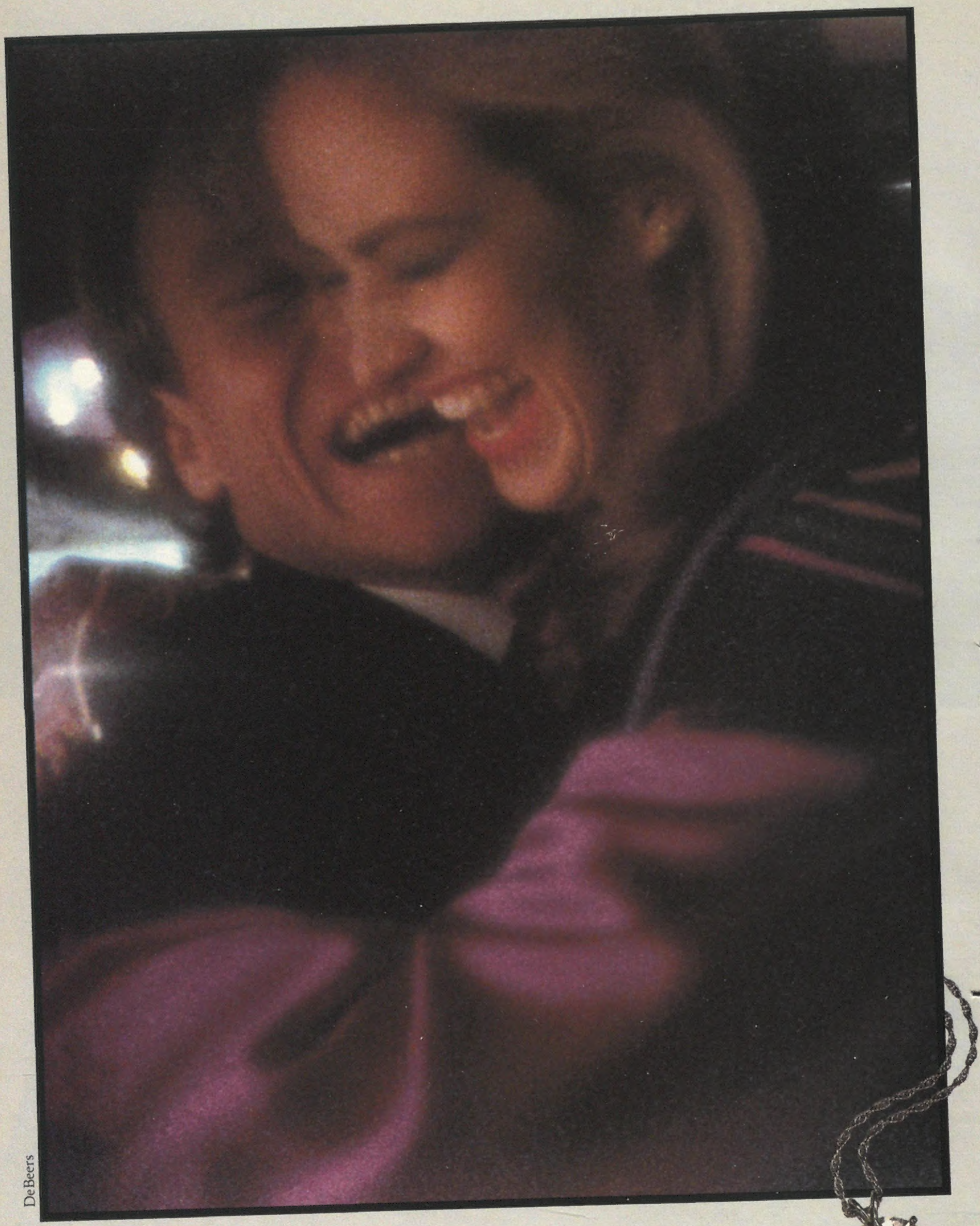

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